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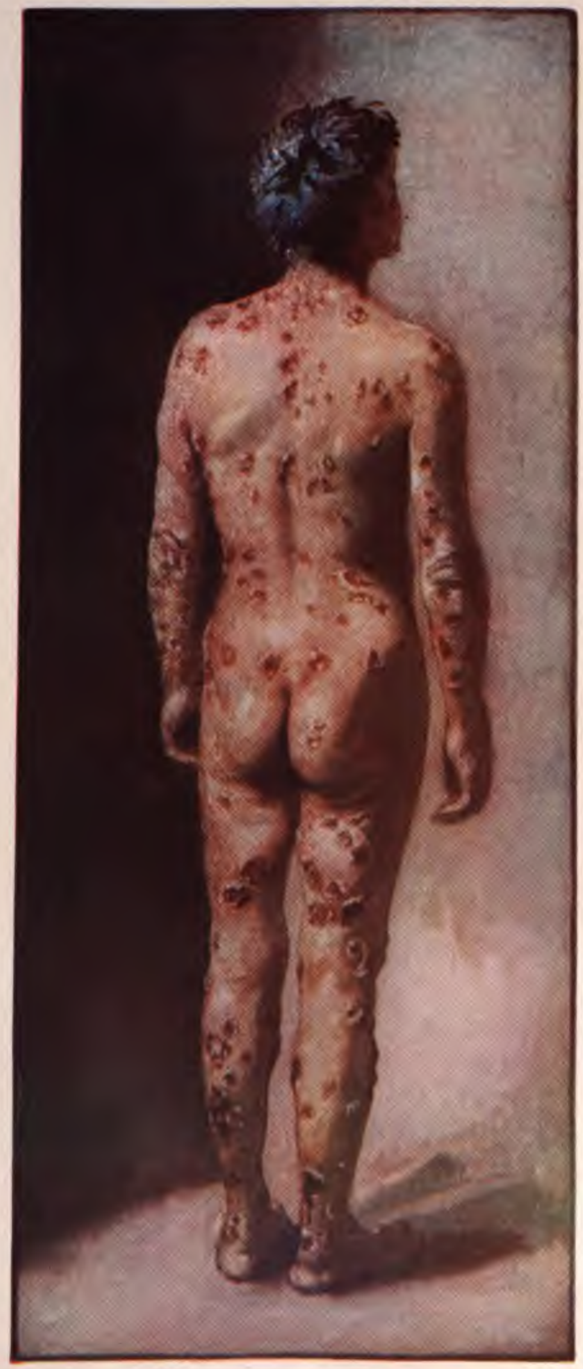

Relapsing Eruption in Late Secondary Syphilis, showing general distribution, asymmetry of arrangement, and ring form of lesions. (Author's case from Long Island College Hospital.)

GENITO-URINARY DISEASES AND SYPHILIS

BY

HENRY H. MORTON, M. D.

CLINICAL PROFESSOR OF GENITO-URINARY DISEASES IN THE LONG ISLAND COLLEGE HOSPITAL; GENITO-URINARY
SURGEON TO THE LONG ISLAND AND KINGS COUNTY HOSPITALS AND
THE POLHEMUS MEMORIAL CLINIC.

Illustrated with 158 Half-tones and Photo-engravings, and 7 Full-page Color-plates

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SECOND EDITION, REVISED AND ENLARGED.

ERRATA.

Page 67—In prescription, third line from top of page. Resorcin should be Resorbin.

Page 143—Second and Fourth lines under Fig. (b and c), perivascular infiltration should peri-vesicular infiltration.

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TO THE MEMORY

OF

MY OLD TEACHER AND FRIEND

DR. ALEXANDER J. C. SKENE

IN RECOGNITION OF HIS BRILLIANT ABILITIES AS A SURGEON
AND IN AFFECTIONATE REMEMBRANCE OF HIS
PERSONAL QUALITIES AS A MAN

THIS WORK IS DEDICATED

6305

PREFACE TO SECOND EDITION.

THE rapid progress in certain of the departments of Genito-Urinary Surgery, since the publication of the first edition of this volume, has made it necessary to rewrite many chapters and add some new material.

Among some of the advances which have been made in the last four years may be mentioned the development and perfection of the surgical operations for prostatic hypertrophy, as well as an understanding of its pathological anatomy.

The inflammatory affections of the prostate have also been more fully studied, and the knowledge of the surgical diseases of the kidney, in regard to both diagnosis and treatment, has been considerably increased.

The author has carefully revised the material contained in the first edition of the book, and in this publication has endeavored to present the subjects considered as they are understood at the present time.

In doing so he was materially assisted by Drs. Frank, Wossidlo, Roescher, Casper, and others, and takes this opportunity of expressing his thanks to them for many courtesies during his stay in Berlin in the summer of 1905.

32 SCHERMERHORN STREET,
BROOKLYN-NEW YORK.

PREFACE.

In the past ten years no branch of surgery or medicine has made greater progress than the department of genito-urinary surgery. In that short period of time, the treatment of acute and chronic gonorrhœa has been removed from mere empiricism and placed upon a scientific and rational basis. This has been accomplished through investigations, whose results have given us a definite knowledge of the micro-organisms concerned, and the pathological changes in the urethral tissues which their presence excites.

The whole subject of chronic seminal vesiculitis, with its relation to sexual neurasthenia, and the ever-present danger of lurking infection, has been clearly demonstrated. It is less than ten years since the cystoscope came to be of practical use, and out of its development grew the various instruments for collecting the urine from each kidney separately, in this way stimulating a greater interest in the subject of renal surgery.

While the operations for stone in the bladder are as old as civilization itself, the improvements in the technique of lithotomy, and a clearer comprehension of the indications for each form of operation, are matters of very recent growth. Ten years ago the cases of hypertrophied prostate in old men were without remedy, after the failure of the catheter to alleviate the urgent symptoms, but to-day the operations of prostatectomy, castration, and Bottini's operation have opened a way of relieving the suffering and prolonging life.

The above-mentioned advances are only a few of the steps in the progress of this important branch of surgery.

In this little volume the author has endeavored to present, in a concise form, the present *status* of genito-urinary diseases and syphilis. At the same time he has endeavored to keep in mind the needs of the practitioner, whose opportunities for seeing such cases may be infrequent, and to consider the questions of diagnosis, prognosis, and treatment in such a way that the book may be of practical use in these matters.

40 Schermerhorn Street,
Brooklyn-New York.

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DISEASES OF THE PENIS.

CHAPTER I.

PHIMOSIS.

By the term phimosis is understood an abnormal narrowing of the opening of the prepuce, which prevents the retraction of the foreskin and causes the glans penis to be permanently covered.

Phimosis may be *congenital* or may be *acquired* in adult life.

In nearly all male children at birth the foreskin is long and is adherent to the glans. In early life these adhesions are very weak and are easily ruptured by erections of the penis or manipulation, and in the course of the first few years the preputial orifice becomes enlarged and the prepuce can be stripped back over the glans. If the adhesions are not ruptured early, they become firmer as they grow older, and prevent the complete retraction of the foreskin.

The *acquired* form of phimosis occurs in adults, and often results from the cicatricial contraction of the margin of the prepuce following the healing of a chancroid in this location.

Temporary phimosis often results from the swelling and œdema of the prepuce which occurs in the course of an attack of gonorrhœa or subpreputial chancroids.

As **direct results** of phimosis the following conditions are met with: —

(*a*) *Balanitis and venereal warts*, resulting from the maceration of the epithelium in the balano-preputial sac, from retention of smegma and urine. On account of the difficulty of retracting the prepuce proper cleanliness cannot be observed, and the tender mucous membrane is especially liable to persistent and recurrent attacks of inflammation. Proliferation of the epithelial cells occurs, and venereal warts grow luxuriantly.

(*b*) *Preputial calculi*, or concretions, form not infrequently, from a calcification of the smegma and the decomposition of the urinary salts.

(*c*) *Epithelioma of the penis* is strongly predisposed to by the continued irritation of the foreskin and retention of the secretions under it.

(*d*) *Arrested development of the penis* usually occurs in consequence of the malnutrition from which the organ suffers.

(*e*) *Premature erections and sexual excitement* are generally noted in young children affected with phimosis, and the continued irritation about the head of the penis often establishes a habit of *masturbation.*

(*f*) *Interference with the act of coitus*, often accompanied by premature ejaculation, is frequently complained of by adults affected with phimosis.

(*g*) *Liability to infection with syphilis or chancroidal poison* is invariably the case when the prepuce is long, even though it can be retracted, and Hutchinson points out that the circumcised Jew is less liable to contract syphilis than an uncircumcised person, because after circumcision the integument of the glans becomes horny, and is not liable to abrasions.

The **remote results** of phimosis are equally important, and often present great difficulties in the exact determination of their origin.

(*a*) *Retention or incontinence of urine,* especially in children, but sometimes in adults, is often caused by a spasmodic contraction of the cut-off muscle or an irritable bladder, induced by the irritation about the glans penis.

(*b*) *Hæmorrhoids, prolapsus ani, hernia, and dilatation of the ureters and kidney pelves* often follow the prolonged and violent straining efforts which individuals affected with phimosis make, upon urinating, in order to overcome the resistance offered by a spasmodic stricture or a pin-point opening through the prepuce. The susceptible nervous system of children renders them particularly liable to the above-mentioned difficulties and also to the following affections:—

(*c*) *Affections of the nervous system,*—spastic palsies, simulated hip-joint disease, muscular inco-ordination, and convulsions,—which are often observed in young children as reflexes from a tight or adherent prepuce, and a disappearance of these symptoms often follows circumcision.

(*d*) *Herpes præputialis* is another manifestation of the reflex action upon the nervous system and skin of the prepuce occasioned by the irritation of a long foreskin, even though it is possible to retract it over the glans.

TREATMENT.

On account of the manifold advantages offered by an absence of the foreskin, it would be well if Christian nations were to adopt the old Hebrew rite of circumcising all male children on the eighth day after birth. In this operation the foreskin is simply snipped off with one sweep of a knife, and the wound washed with a weak astringent antiseptic. The pain is slight, and an anæsthetic is not required, nor would it be safe to administer one, in so young a child. Hæmorrhage is trifling, and there is but little risk of infection afterward.

Stripping back the foreskin and breaking up the adhesions is sometimes recommended, but is a very poor makeshift for circumcision, and there is always the danger of the prepuce being caught back behind the glans, and becoming swollen and constricted, causing *paraphimosis.*

Circumcision is the operation of choice, and may be performed in two ways:—

(a) Circumcision with a Clamp.—In this operation the clamp is applied to the foreskin immediately below the glans penis, and all the prepuce which projects beyond the clamp is severed with a knife or scissors. This incision simply cuts through the skin alone, and the mucous membrane lying next the glans is left intact and must next be trimmed off with the scissors. After this is done the cut edges of skin and mucous membrane are stitched together with interrupted sutures of catgut, and the operation is completed.

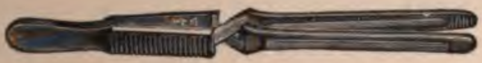

Fig. 1.—Clamp for Circumcision.

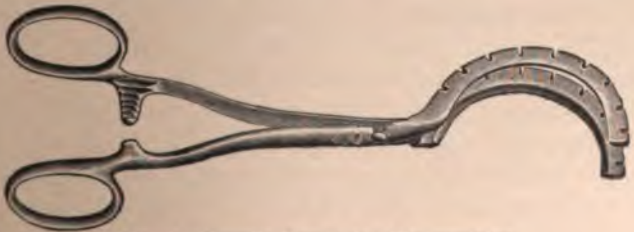

Fig. 2.—Beard's Clamp for Circumcision.

There are certain objections to this procedure. In applying the clamp, if too much traction is made on the foreskin, the skin of the proximal end retracts close up to the root of the penis after the incision is made, and leaves a gaping raw surface of mucous membrane to be covered. On the other hand, if too much foreskin is left, the glans remains covered by it and the object for which the operation was performed is not accomplished. Even when the incision is properly made the subsequent adjustment of skin and mucous membrane often induces a certain amount of tension and dragging upon the sutures, which interferes with the healing of the wound.

(b) Circumcision by Dorsal Incision and Trimming off the Flaps.—The surgeon stands upon the patient's left side and with a pair of straight scissors makes an incision on the dorsum of the prepuce, cutting through skin and mucous membrane at the same time. The incision is carried up to the point three-eighths of an inch from where the mucous membrane is reflected upon the glans penis. A grooved director may be introduced under the foreskin if desired, to act as a guide for the scissors.

After the dorsal incision is made the two remaining flaps of skin and mucous membrane are trimmed off with curved scissors. This incision is carried around the penis on both sides, following the line of insertion of the mucous membrane at a distance of three-eighths of an inch from the glans.

The frænum is divided last, and its artery, together with the dorsal artery, and sometimes one or two smaller ones, are picked up and tied, and the sutures are introduced.

It is desirable to place the first suture on the dorsum of the penis, and the second suture stitches the remains of the frænum to the point of skin underneath it. These anchor the skin and prevent it from shifting, as it lies on the mucous membrane. The other sutures are then introduced, and usually three on a side will be found enough. Fine catgut is the best material, as it is absorbed, while if silk sutures are used much trouble is experienced in removing them.

The best form of dressing seems to be a piece of lint wet with an antiseptic solution and changed frequently, as any sort of permanent dressing is soon soaked with urine. The patient should remain quietly in bed or on a lounge, for a week, and may be then allowed to go about as usual.

Very recently a new form of operation has been devised with **Beard's clamp**, which has certain advantages.

By means of this clamp the flaps can be trimmed off even, and Schleich's infiltration of cocaine can be used as local anæsthesia.

Technique.—A 4 per cent. cocaine solution is injected along the dorsum of the penis, and a dorsal incision through the skin and mucous membrane is made with scissors.

The flap thus formed is grasped with the clamp and cocaine injected along its outer edge.

The flap is then trimmed off with scissors, using the edge of the clamp as a guide.

The sutures are inserted through the skin and mucous membrane, the notches in the clamp serving as guides for placing them.

The clamp is then removed and the opposite side treated in the same way.

With regard to the anæsthetic employed, some surgeons use cocaine injection by Schleich's infiltration method.

The objection to cocaine injected hypodermically in the older operations of circumcision with a clamp or by dorsal incision is, that the skin shrinks so much under the effect of the cocaine, that landmarks are obliterated and the surgeon is apt to cut off too much skin and mucous membrane. The œdema of the cellular tissue resulting from tying a rubber bandage around the root of the penis to prevent the too rapid absorption of the cocaine interferes with the healing of the wound afterward.

These objections seem to be removed by using Beard's clamp, and it would seem as though it might be a valuable adjunct in the operation.

On account of the objections to the use of cocaine, the author prefers to use a general anæsthetic, and nitrous oxide is well adapted to the purpose.

HYPOSPADIAS.

Hypospadias is the most frequent malformation occurring in the penis, Rennes finding it once in every 300 French army rcruits.

The deformity often exerts a depressing psychical influence on the individual's mind; the garments are soiled with urine, there is difficulty in expelling the stream of urine, and in doing so the patient assumes the squatting posture.

The scrotum, constantly wet with urine, becomes eczematous, and coitus is often difficult on account of the incurvation of the penis.

Fecundation is nearly always impossible, and in 100 cases of married hypospadiacs examined by Beck none was found to have children.

The forms in which hypospadias occurs are described by Treves as follows:—

1. The balanitic opening is at the side of the corona, the frænum is absent, and a hoodlike prepuce exists.

2. The penile urethra may open at any part of the under surface of the penis, and if the opening be far back nearly the whole of the penile urethra is absent so far as its floor is concerned.

3. Scrotal hypospadias.—Here the opening is at the junction of tho penis and scrotum, or is on the perineal side of the scrotum.

In most cases the penis is small and deformed, and is held in a curved position by the rudimentary urethra on its under surface.

The operations of Dupuytren and Thiersch are best adapted to scrotal and marked examples of penile hypospadias.

In these operations a new canal is made by dissecting up flaps on either side of the penis and building from them, a new urethra, around a sound, which serves as a mould.

While the technique of these operations is not especially difficult, the subsequent healing is interfered with by the leakage of urine, with infection of the stitch-wounds, and primary union is the exception.

BECK'S OPERATION[1]

is based on the fact of the extraordinary distensibility of the urethra, which can be utilized for restoring either penile or balanic hypospadias.

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[1] New York Medical Journal, December 8, 1900.

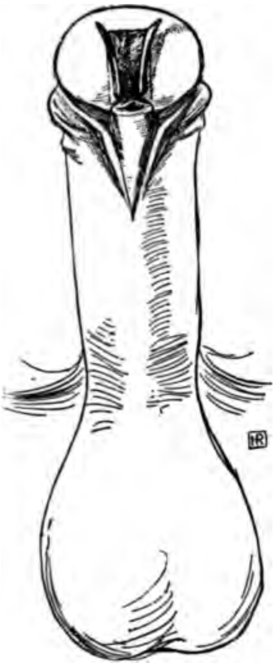

Fig. 3

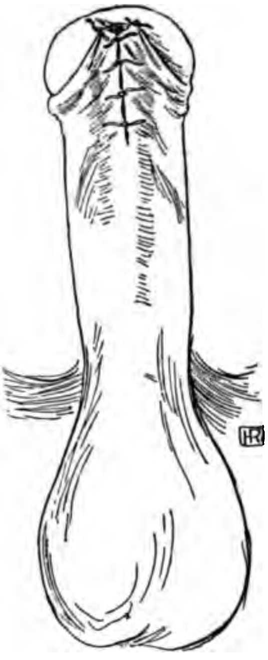

Fig. 4.

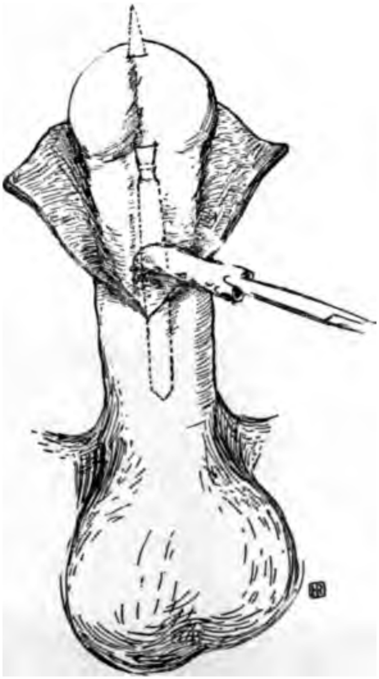

Fig. 5.

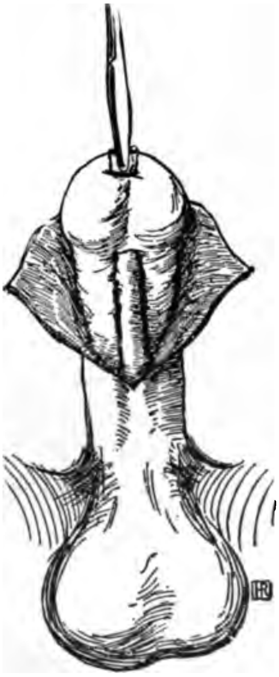

Fig. 6.

Instead of forming a new urethra, the existing one is utilized by dissecting it free and dislocating it forward. As time elapses after the operation, the urethra becomes more elongated and adapts itself to the new position.

If the case is left untreated until adult life, the penis becomes short, wasted, curved, and often cannot be straightened.

It would naturally be supposed that during erection after an operation, the short urethra would draw down the glans and a curvature of the penis would follow.

Beck's experience, however, in a number of cases shows that this does not follow, particularly when the operation is performed in childhood.

Technique.—A soft rubber catheter or steel sound is introduced into the urethra, and an incision is made through the skin and fascia from the abnormal opening backwards to the posterior third of the pendulous urethra.

A transverse incision is then made through the skin in the coronary sulcus, thus freeing the upper angles of the wound.

The urethra is then dissected in its whole length from its bed in the corpora cavernosa. The hæmorrhage is but trifling.

The next step of the operation consists in forming a bed in the glans to receive the end of the loosened urethra.

(*a*) This may be done in two ways. The first method, which in general is to be preferred, is by forming two flaps, by making lateral incisions alongside of the groove in the glans. The end of the urethra is then placed in the wound-bed, covered with the flaps, and held in place with catgut sutures. (Figs. 3 and 4.)

(*b*) By the other method the glans is tunnelled, by thrusting a narrow-bladed, straight bistoury through it from below upward. The incision is enlarged sufficiently so that the urethra can be drawn through it by means of a long, narrow forceps, and held in place by four catgut sutures. (Figs. 5 and 6.)

The after-treatment is very simple, and consists in bandaging the penis in iodoform gauze and keeping a wet dressing over the newly-formed orifice.

In adults, after an operation, especially in the case of a penile hypospadias, a slight incurvation is noted during erections.

This is best treated by the introduction of large metal sounds, which are allowed to remain in place for a time. If the incurvation becomes considerable, longitudinal incisions are made alongside the urethra into the penis.

STRICTURE OF THE MEATUS.

The meatus differs very much in size. Usually it is large enough to admit a 28 or 30 sound, but often it is so small that only a 22 sound can be introduced, or it may even be pin-point in size. Narrow meatus is usually a congenital deformity, but it sometimes occurs as a consequence of cicatricial contraction following a chancroid of the meatus.

SYMPTOMS.

Narrow meatus often gives rise to no symptoms and does not in itself require treatment. Not infrequently, however, it prevents a complete emptying of the urethra, during urination; a few drops of urine remain behind in the fossa navicularis, decompose, and cause a chronic inflammation of the mucous membrane.

The inflammatory process acts in a reflex way, inducing a spasmodic contraction of the cut-off muscle, with permanent or occasional retention of urine.

In cases of chronic urethritis, the presence of a narrow meatus interferes with the proper drainage of the urethra, and the irritation of the decomposing urine prevents the post-gonorrhœal lesions from healing. Some of these cases are cured by doing a meatotomy.

In every case where instrumentation of the urethra or bladder is required, as in litholapaxy, cystoscopy, urethroscopy, or sounding, if the meatus is too small to admit the instrument, it must be incised.

It is bad surgery to attempt to force an instrument through a narrow meatus; the pain caused is excessive and the meatus is liable to be torn, while the operation of **Meatotomy** is very slight and without risk.

TECHNIQUE.

A rubber band is tied around the penis, to serve as a tourniquet.

A few drops of a 4 per cent. solution of cocaine are injected hypodermically into the frænum and the meatus incised with a straight, blunt-pointed bistoury *on its floor,* sufficiently to admit a bulbous bougie, No. 30 French.

The fresh wound may then be stuffed with Schleich's glutol, a bandage applied, and the patient allowed to go about.

The patient should be instructed to pass a meatus-sound three times a day, until the wound is healed. If this is not done, the cut surfaces will adhere and the opening close.

In very rare cases a severe hæmorrhage follows meatotomy, due to wounding the artery of the frænum.

If it is entirely severed, the artery retracts and closes; but if only partially cut through, it continues to bleed. The hæmorrhage may be controlled by passing a catheter through the meatus and making counter-pressure by firm bandaging around the end of the penis.

BALANO-POSTHITIS.

Balanitis consists in an inflammation of the mucous membrane covering the glans penis, and an inflammation affecting the mucous layer of the prepuce is termed posthitis. The inflammation of both surfaces usually exists simultaneously, and should be considered together.

Balano-posthitis cannot occur in an individual who has been circumcised, but the presence of a long and phimotic foreskin allows the retention of the natural secretion of smegma and a few drops of urine, which decompose and irritate the already macerated mucous membrane, lowering its power of resistance to germ-infection.

Gouty and lithæmic conditions and diabetes also render the patient extremely liable to develop inflammation of the mucous membrane underneath a long foreskin.

As a direct exciting cause it is probably necessary that micro-organisms of some sort must be inoculated, and for this reason a balano-posthitis often develops from contact with irritating vaginal secretions in coitus or the accidental introduction of pyogenic organisms from contact with the hands or clothing.

Chancre, gonorrhœa, and chancroid are apt to be complicated by balano-posthitis as a result of mixed infection, when they occur in an individual having a long foreskin.

SYMPTOMS AND COURSE.

A mild form of balano-posthitis is liable to occur at frequent intervals unless the man with a long foreskin attends with scrupulous care to drawing it back and washing it, and the preputial sac, at frequent intervals.

If this is not done, a sense of heat and itching is noticed at the end of the penis; the mucous membrane becomes hyperæmic, infiltrated, and eroded; and a creamy-yellow, purulent discharge, with an extremely offensive odor, is secreted from the mucous membrane of the preputial sac.

In *severe* cases the excoriations are extensive and well-marked and the inflammation and œdema are extreme; so that the whole prepuce becomes swollen. In this condition *gangrene* of the foreskin, either in part or as a whole, not infrequently takes place.

DIAGNOSIS.

The diagnosis of balano-posthitis presents but little difficulty, when the foreskin can be retracted and the glans inspected; but when phimosis exists the diagnosis is often perplexing.

If a microscopic examination of the discharge fails to reveal gonococci, but discloses numerous staphylococci, gonorrhœa may be excluded.

Chancroid may be diagnosed by inoculating some of the preputial discharge upon the patient's thigh, and, if other chancroids are caused, it is probable that the original sore was a chancroid, although it is possible to cause sores resembling chancroids by the inoculation of staphylococci.

Chancre can be excluded by the absence of an indurated mass under the prepuce and the lack of the characteristic enlargement in the inguinal glands.

Epithelioma is often difficult to differentiate from the chronic form of balano-posthitis which affects middle-aged men; but epithelioma does not respond to local treatment, while balanitis improves quickly. In cases of doubt it is always in order to excise a small portion of the prepuce and subject it to microscopic examination to determine the question.

TREATMENT.

The essential points in the treatment are to keep the *parts clean and dry*. These indications can be met in the following manner:—

In the cases when the *prepuce can be retracted,* the balano-preputial sac should be washed out with a mild antiseptic solution, either bichloride (1 in 10,000 to 1 in 4000) or Thiersch's fluid. The parts should then be dried and covered with a dusting-power:—

℞ Pulv. amyli,	
Pulv. zinci oxidi,	
Pulv. talci	aa ʒij.

Or:—

℞ Hydrarg. chlor. mite	gr. xxx.
Acidi borici	gr. xv.
Acidi salicylici	gr. v.

In chronic cases, occurring in elderly men, subgallate of bismuth has a particularly good effect.

After applying the dusting-powder the glans should be covered with a layer of cotton and the foreskin drawn forward into place. This dressing should be changed several times a day.

If the erosions are deep and extensive, their healing can be hastened by brushing them over with a 10-per-cent. nitrate-of-silver solution before applying the dusting powder.

When *phimosis* exists and the *foreskin cannot be retracted,* a long, flat-billed syringe should be used for washing out the balano-preputial sac, every few hours.

A few syringefuls of warm water and soap may be thrown in and followed by injecting bichloride solution (1 in 10,000) or Thiersch's fluid.

The œdema and swelling of the parts may be mitigated by prolonged soaking in hot water.

If the balanitis occurs as a result of diabetes or a subpreputial chancroid, it may be necessary to relieve the tension by slitting up the prepuce on the dorsum in order to avert impending gangrene.

In all cases of chronic or relapsing balano-posthitis, in addition to local measures, attention should be directed to the diathetic conditions which prevent a permanent healing. If the individual is gouty or diabetic, a suitable regimen should be adopted, and the general health carefully looked after.

In obstinate cases of balano-posthitis, circumcision should be performed as soon as the acute symptoms have subsided. This is especially necessary in elderly men, who are at an age when epithelioma is liable to develop on the glans or under the prepuce from the prolonged irritation of the parts.

In diabetic patients the operation of circumcision should be avoided if possible and the danger of extensive gangrene following slight operations should be borne in mind. If any operative procedure is demanded, it is of the highest importance to get the patient's urine in good condition before operating.

HERPES PROGENITALIS.

This affection is characterized by the formation of groups of small vesicles upon an erythematous base and located on the skin or mucous surface of the prepuce.

The thin vesicles are easily ruptured, and leave small, round, shallow, punched-out ulcers, which heal spontaneously in a few days.

Unlike herpes zoster, herpes progenitalis is generally unaccompanied with pain. In exceptional cases, however, pain is felt, which is neuralgic in character and precedes the appearance of the eruption.

A urethral discharge is sometimes observed, and endoscopic examination shows a collection of vesicles located *within* the urethra.

Recurrence is a marked characteristic of herpes progenitalis, and it is the rule for patients to have several attacks a year.

ETIOLOGY.

Herpes progenitalis may be regarded as a reflex manifestation of some irritation of the nerves supplying the genitals, and is usually due to balano-posthitis, excessive coitus, or a long prepuce. Gouty and lithæmic conditions are thought to predispose the patient to attacks of herpes.

DIAGNOSIS.

If the case is seen early, the appearance of the vesicles is unmistakable, and after they have ruptured the small, round, punched-out ulcers are quite characteristic.

The lymphatic glands in the groin are usually not affected, but in one case in ten the inguinal glands are said to be enlarged in a chain, as in syphilis. (J. W. White.)

TREATMENT.

The herpetic lesions rapidly heal with cleanliness and the application of a simple absorbent dusting-powder. Recurrent herpes progenitalis, which almost always occurs in connection with a long foreskin, can only be prevented by the operation of circumcision.

PAPILLOMATA.

Papillomata occurring about the head of the penis are frequently termed *venereal warts.* They are sometimes spoken of as *condylomata,* which is manifestly incorrect, as true condylomata are a manifestation of syphilis, and the papillomata have no connection with syphilis, but are of purely local origin.

Papillomata consist in warty growths, which are flat or often cauliflower-like excrescences, usually located in the coronary sulcus under a long prepuce. In structure they are a simple hypertrophy of the papillary layer, and are caused by the prolonged maceration and softening of the mucous surfaces under a long foreskin, occasioned by contact with irritating discharges from gonorrhœa, chancroids, or balano-posthitis.

DIAGNOSIS.

Papillomata may be mistaken for the condylomata of syphilis or epithelioma. In syphilitic condylomata, however, other signs of specific disease are always present; but epithelioma may be difficult to differentiate from simple papillomata, and every warty growth occurring about the glans penis in elderly men should be regarded with suspicion.

TREATMENT.

Small warts sometimes disappear if the parts are kept clean and covered with a dusting-powder; but their disappearance is a matter of uncertainty, and always very slow. Operation is the best treatment, and should always be advised.

As papillomata occur in consequence of a long foreskin, circumcision should be performed, and the warts which are not removed with the prepuce scraped off with a sharp curette. In order to prevent a recurrence, it is desirable to cauterize the bases with nitric or carbolic acid or the Paquelin cautery.

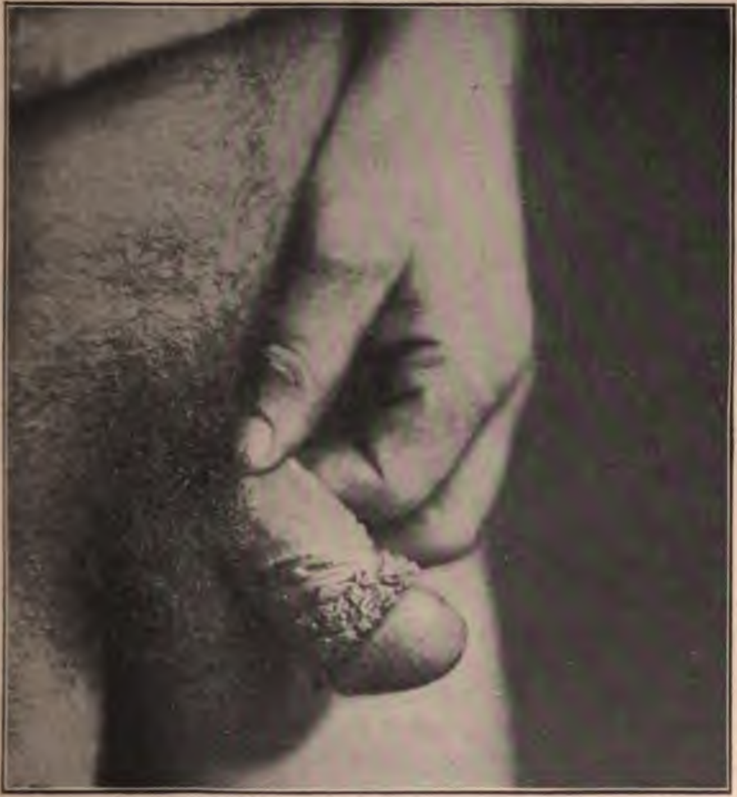

Fig. 7.—Papillomata—Venereal Warts. (Author's Case, from Kings County Hospital.)

CANCER OF THE PENIS.

Malignant disease of the penis occurs almost invariably as epithelial carcinoma, and begins with about equal frequency on the inner surface of the prepuce or upon the glans.

According to Jacobson, its mode of commencement is varied, but it appears most frequently as: (*a*) *A wart,* or *warty excrescence.* Sometimes, however, it makes its appearance as: (*b*) *A small nodule,* or *knot of induration,* under the surface of the mucous membrane.

Again, epithelioma is observed occurring under the form of (*c*) *a superficial excoriation,* or *raw patch,* resembling the erosions found in balano-posthitis; or it may develop as (*d*) *an ulcer* resulting from the transformation of a chancroid or the breaking down of an old cicatrix, or sometimes from a crack or tear on the margin of a tight foreskin.

In cases of extreme rarity epithelioma of the penis develops from the *extension of the malignant process* outward from the urethra or upward from the scrotum.

ETIOLOGY.

Under the head of predisposing causes *age* plays an important rôle, and epithelioma of the penis is very rarely found except between the fiftieth and seventieth years.

Th next most important predisposing cause is *phimosis.* Demarquay found that out of fifty-nine cases of epithelioma of the penis, forty-two had long and phimotic foreskins, and many authors have called attention to the fact that the circumcised Jews are almost entirely free from this disease.

Even though the glans be covered with a long foreskin, if the individual attends to the daily cleansing of the balano-preputial sac there is no opportunity for irritating secretions to be retained; but we notice that cancer of the penis almost always occurs in men in the lower walks of life, of neglectful and uncleanly personal habits.

Any condition which gives rise to a balano-posthitis, such as the retention of decomposed smegma and urine under a phimotic foreskin, particularly if aggravated by a gouty diathesis in the patient, excites a persistent and long-continued irritation. In an elderly person in course of time the simple inflammatory process undergoes a transition into carcinoma of a polymorphous type, composed of large pavement-cells and small epithelial cells.

COURSE.

No matter in what form the disease had its origin, its course is one of extension at the edges, accompanied by ulceration and breaking down in the older parts, and in most cases this is attended by the formation of large vegetations, or fungosities, resembling a cauliflower in shape.

A thin fluid, of a most disgusting odor, which dries into scabs, is continually secreted.

As the cancerous process extends only by continuity, its advance through the corpora cavernosa is not rapid, but the lymphatics readily take up the infectious material, carry it to the glands in the groin, and these are usually involved quite early in the disease.

The inguinal lymphatic glands are often the seat of a mixed infection, if pyogenic bacteria have been conveyed to them through the lymphatics and cause them to become inflamed and suppurate.

DIAGNOSIS.

Every warty or papillomatous growth, or persistent erosion occurring on the glans penis, or inner surface of the prepuce, in an elderly person, should always be regarded with grave suspicion.

It is often difficult to differentiate simple papillomata or a chronic balano-posthitis from carcinoma, but the age of the patient, the long, protracted duration of the sore, together with a base which is hard, infiltrated, and immovable, and an edge which is hard and infiltrated, would point strongly in the direction of epithelial carcinoma. The diagnosis could be definitely determined by cutting a small piece from the growth and subjecting it to microscopic examination.

A gumma of the penis occurring in tertiary syphilis might be easily mistaken for epithelioma; but a few weeks' treatment with mercury and iodides would cause the gumma to disappear.

PROGNOSIS.

The prognosis of epithelioma of the penis is, of course, fatal without operation, and death occurs in from one to two years. If the disease is seen early and the growth removed by amputation of the penis and extirpation of the groin glands, the prognosis is good; but many cases come into the hands of the surgeon too late for a complete removal of all the foci of infection. Winiwarter reports

12 amputations, of which 5 remained permanently well, 1 died of the operation, and 6 had recurrences, 3 of which were in the stump and 3 in the glands.

TREATMENT.

As already indicated, complete removal of all deposits at the earliest possible moment offers the patient the only opportunity of saving his life, and the application of caustics only excites greater activity in the growth and is a waste of valuable time.

Two forms of operation are in use, and a selection depends upon the extent to which the inguinal glands and corpora cavernosa are involved.

OPERATIONS.

Amputation of the Free Portion of the Penis.—*Technique.*—A No. 20 French sound is introduced through the meatus into the bladder to indicate the position of the urethra.

A harelip-pin is thrust through both corpora cavernosa, at the root of the penis, to hold in place a rubber band, which is made to encircle the penis and act as a tourniquet.

The skin of the penis is then cut through with a circular sweep of the knife, and turned back an inch. The corpora cavernosa are divided, down to the corpus spongiosum, which, with the urethra, is left to project like a spout for an inch, before being cut through.

The tourniquet is then unloosed and at least four arteries will require ligation. The skin-flaps are sutured together, and the urethra stitched to the margins of the skin-flaps.

A soft-rubber catheter is tied in the bladder to prevent the urine from infecting the fresh wound.

Amputation of the Entire Penis.—This is a much more serious operation than the former, but is demanded in the case of extensive infiltration of the corpora cavernosa with cancerous deposit.

Technique.—The patient is placed in the lithotomy position, and a sound is introduced through the urethra into the bladder. An incision is made along the raphé of the scrotum, splitting it into two halves. The dissection is carried down so that the corpus spongiosum is seen perforating the triangular ligament, with the corpora cavernosa lying on either side and attached to the rami of the pubes. (Fig. 8.)

The corpus spongiosum, containing the urethra, is then dissected away from the corpora cavernosa for three inches, cut through, and

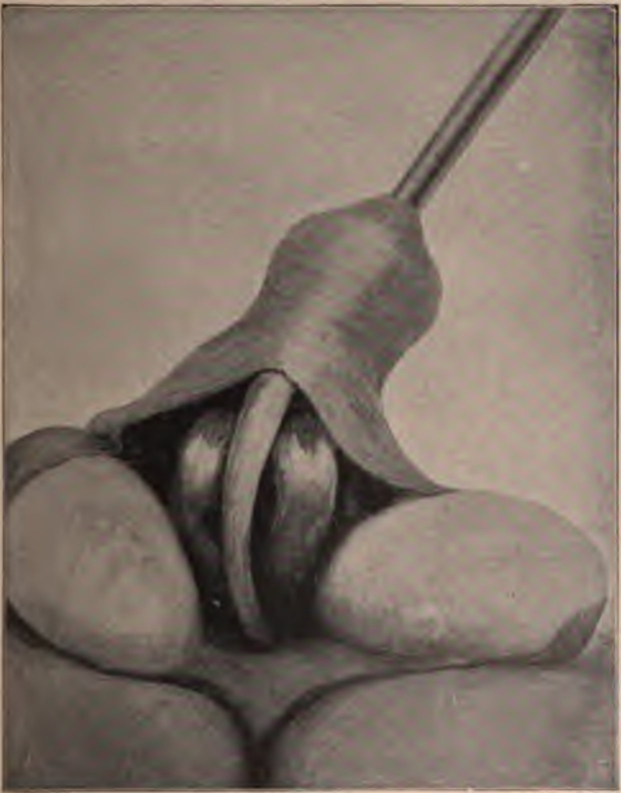

Fig. 8.—Incision dividing Scrotum into two halves and exposing corpus spongiosum, urethra, corpora cavernosa, and triangular ligament. (From Jour. Amer. Med. Assoc., Feb. 22, 1902.)

allowed to hang down out of the way, at the lower angle of the wound. (Fig. 9.)

The next step is to separate the corpora cavernosa from their attachments to the rami of the pubes. It is generally recommended that this should be done with a periosteal elevator. The close attachment to the bones renders this a matter of considerable difficulty, and after separation there is a free hæmorrhage, which is difficult to control.

The author prefers to burn through the crura penis, with a Paquelin cautery, close to their attachments to the bone, and in this way the corpora cavernosa are readily freed from the pubes and without hæmorrhage. (Fig. 10.) The Paquelin can also be used to stop bleeding, which generally occurs from the dorsal vessels of the penis under the symphysis pubis, at the upper angle of the wound.

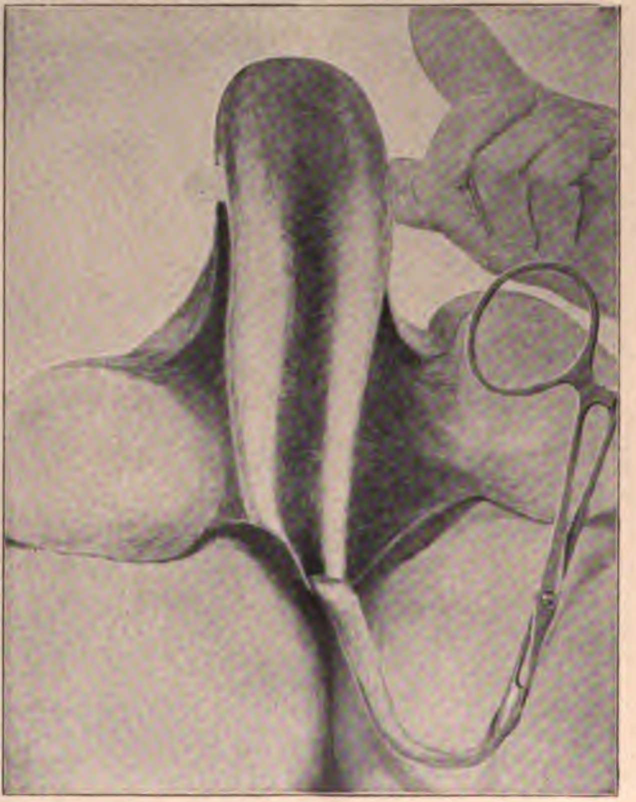

Fig. 9.—Corpus spongiosum containing urethra dissected away from corpora cavernosa, cut through and hanging down at lower angle of the wound. (From Jour. Amer. Med. Assoc., Feb. 22, 1902.)

The final steps of the operation consist in bringing the urethra up into the wound and stitching it to the margins of the skin-flaps, and then the skin on either side is brought into apposition and stitched, and a gauze drain is introduced along the under side of the urethra to the bottom of the wound. (Fig. 11.)

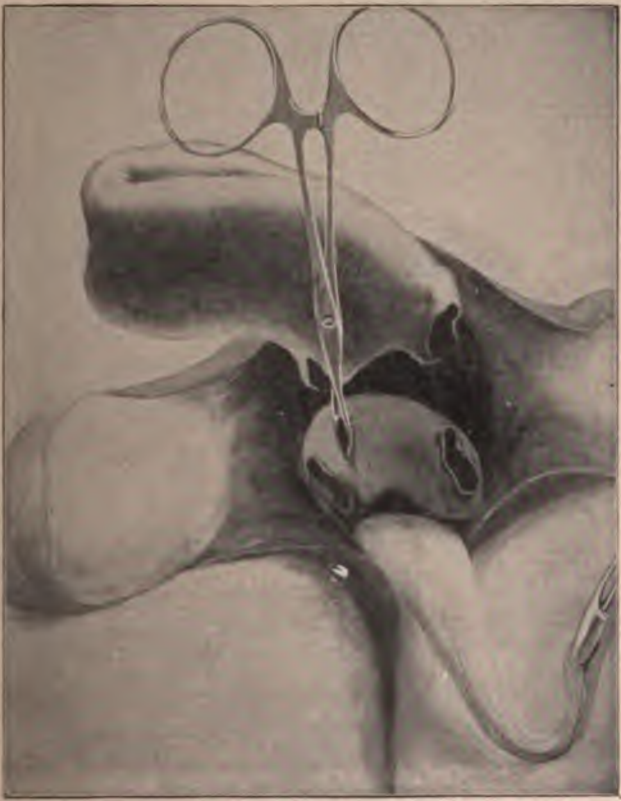

Fig. 10.—Charred stumps of corpora cavernosa after separation from pubes by burning through them with Paquelin Cautery. (From Jour. Amer. Med. Assoc., Feb. 22, 1902.)

A catheter may be carried through the urethra and left in the bladder to drain it.

In this operation the testicles are exposed and may be left in the wound, or castration may be performed, to quell the sexual desire on the part of the patient after his recovery.

The inguinal lymphatic glands should be removed at the time any operation is performed for the relief of malignant disease of the penis, for if the glands have become infected, which occurs early in the disease, a recurrence of the cancer will inevitably take place later on.

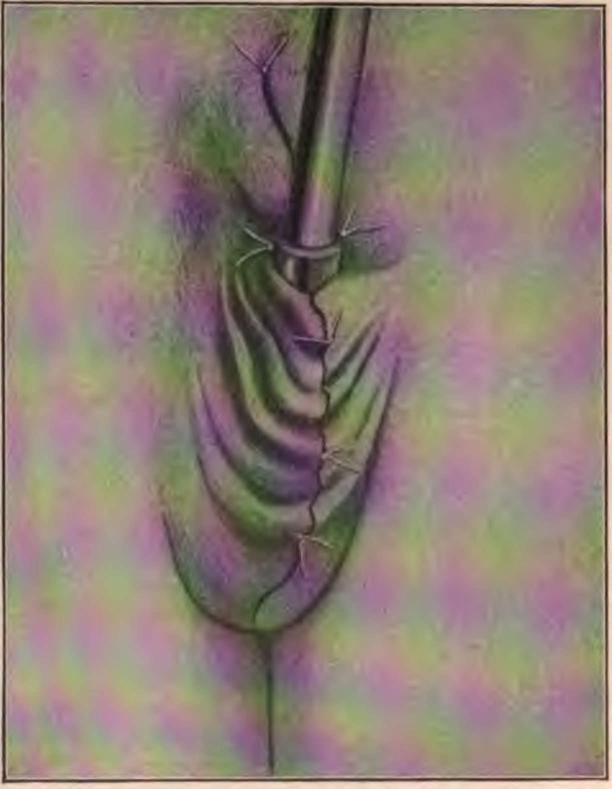

Fig. 11.—Operation as completed. Urethra sutured into wound, with sound introduced through it. (From Jour. Amer. Med. Assoc., Feb. 22, 1902.)

DISEASES OF THE URETHRA AND ITS ADNEXA.

CHAPTER II.

ANATOMY OF THE URETHRA.

THE urethra is a canal, open at both ends, whose walls lie in wrinkled folds and come closely in contact, except when distended by the passage of urine or a catheter.

The length of the canal from meatus urinarius to sphincter vesicæ is about eight inches and it is divided into three regions:—

(*a*) The anterior or pendulous urethra, which is six inches in length.

(*b*) The membranous urethra, which is about one inch long.

(*c*) The prostatic, or posterior, urethra, which is one inch in length.

The anterior urethra is surrounded by the erectile tissue of the corpus spongiosum, which terminates in the bulb. At a point corresponding to the bulb, in the anterior urethra, and lying between the peno-scrotal junction and the anterior layer of the subpubic triangular ligament, for a distance of an inch, is a part of the canal which is termed the *bulbous urethra.*

The membranous urethra is the portion of the canal lying between the anterior and posterior layers of the triangular ligament. Its mucous membrane is not so richly supplied with mucous glands and follicles as the other portions of the urethra, and it acts as a barrier to the onward progress of a gonorrhœal inflammation.

The membranous urethra is surrounded by bands of voluntary muscular fibers known as the **cut-off muscle,** or *compressor urethræ,* which is normally in a state of tonic contraction, and acts as a valve to separate the anterior from the posterior urethra.

Before the act of urination the cut-off muscle is relaxed in order to allow the urine to flow out past it, and by its voluntary contraction the flow of urine can be instantly shut off.

The cut-off muscle is sometimes affected by a cramp-like contraction and fails to relax, causing retention of urine or rendering it difficult or impossible to pass a sound. This condition is known as spasmodic stricture.

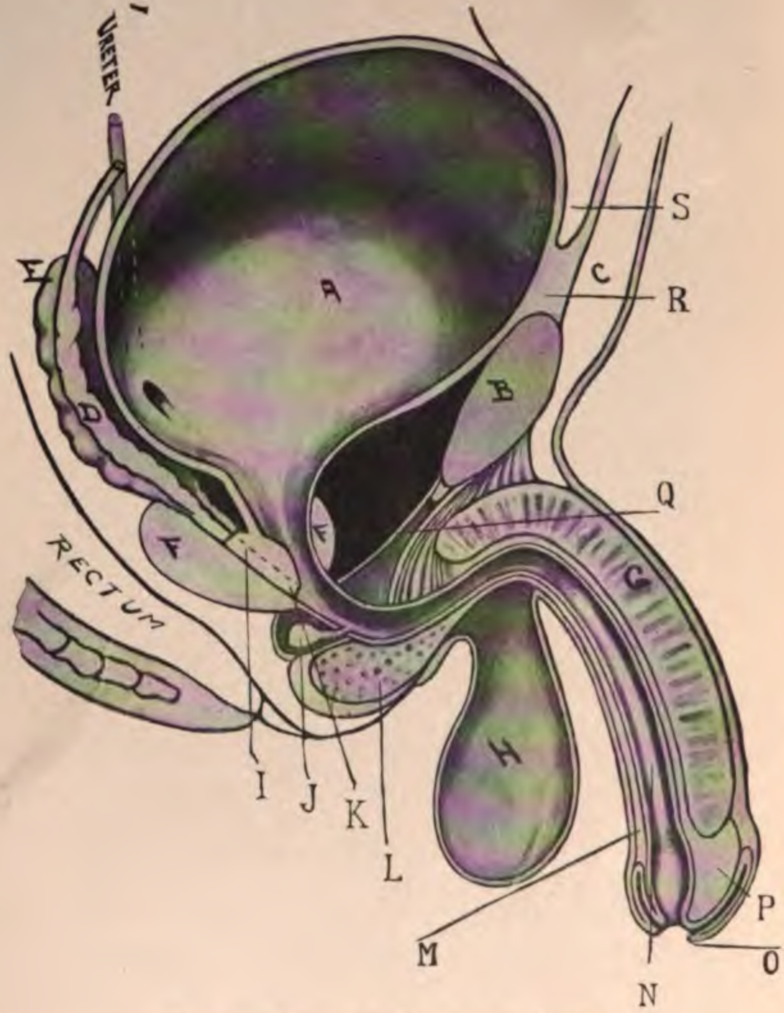

Fig. 12.—Diagram of Bladder and Urethra.

A, Interior of Bladder.
B, Symphysis Pubis.
C, Integument.
D, Vas Deferens.
E, Vesiculæ Seminales.
F, Prostate Gland.
G, Corpus Cavernosum.
H, Scrotum.
I, Verumontanum.
J, Cowper's Gland.
K, Orifice of Ejaculatory Duct.
L, Bulb of Corpus Spongiosum.
M, Corpus Spongiosum.
N, Urethra.
O, Prepuce.
P, Glans Penis.
Q, Suspensory Ligament.
R, Space of Retzius.
S, Peritoneal Fold.

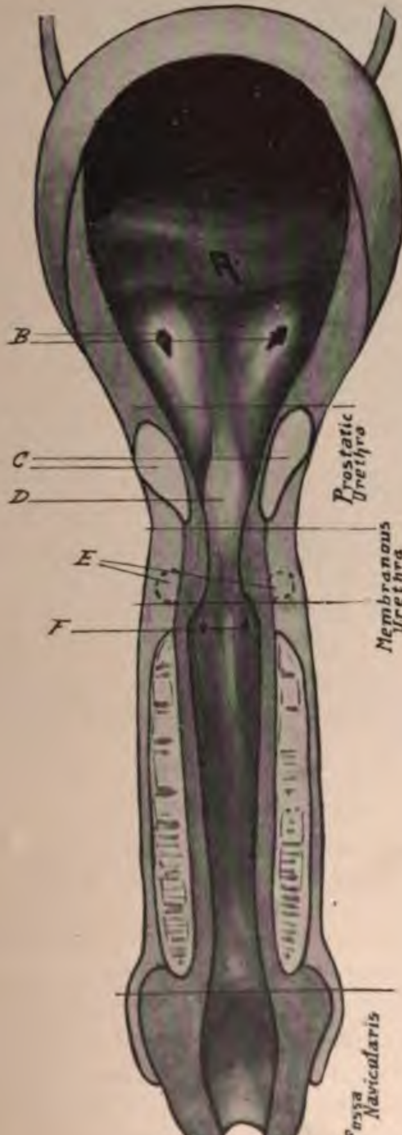

Fig. 13.—Diagram of Bladder and Urethra.

A, Bladder Base.	*D*, Verumontanum, or Colliculus Seminalis.
B, Opening of Ureters.	*E*, Cowper's Glands.
C, Prostate Gland.	*F*, Mouth of Ducts from Cowper's Glands.

The prostatic, or **posterior, urethra** perforates the prostate gland. It is very richly supplied with mucous glands and follicles. Upon its floor is a small elevation composed of erectile tissue and abundantly supplied with nerves, and called the *verumontanum,* or *caput gallinaginis.* At its base, in front, is a small depression, the sinus pocularis, or uterus masculinus.

The ejaculatory ducts from the seminal vesicles empty on either side of the verumontanum, at the margin of the sinus pocularis.

The prostatic sinuses are two small depressions on either side of the verumontanum, upon the floor of the urethra.

The prostatic ducts are usually twelve in number, but may be twenty or thirty, and open into the prostatic sinus at the right and left sides, in a regular linear arrangement.

The ducts from the middle lobe of the prostate empty into the upper section of the posterior urethra, between the verumontanum and the bladder, while the ducts from the lateral lobes empty at either side of the verumontanum.

The urethra is not like a tube of uniform calibre, but is a canal of varying width and distensibility. There are three points of **physiological narrowing:**—

I. At the meatus.

II. Somewhere in the third inch.

III. The membranous urethra, lying between the anterior and posterior layers of the triangular ligament.

The points of **widening** which are susceptible of instrumental dilatation to a considerable extent are as follows:—

I. The fossa navicularis, which is located just within the meatus, and contains in its roof a large mucous crypt: the lacuna magna.

II. The bulbous urethra, which lies just in front of the triangular ligament and extends for one and one-half inches. It is the widest and most dilatable part of the anterior urethra.

III. The prostatic urethra, usually termed the posterior urethra, is capable of greater distension than any other portion of the urethral canal, and may dilated to 40 or 45 of the French scale without injury.

The mucous membrane which lines the anterior and membranous urethra is soft, delicate, and easily lacerated, and is composed throughout its entire length, excepting the fossa navicularis, of epithelial cells of the *cylindrical* variety.

The epithelium lining the prostate urethra is of the transitional variety, the deepest layer being formed of cylindrical cells, while above

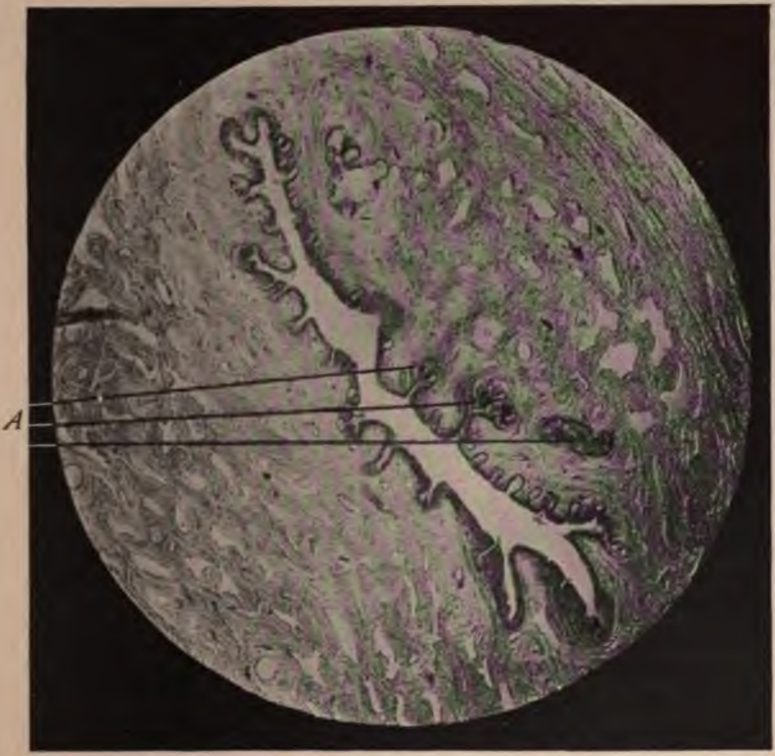

Fig. 14.—Cross-section of urethra, showing Littré's Glands.
A, Glands of Littré.

these is a layer of polygonal or irregular-shaped cells, and the most superficial layer is composed of several strata of large, flattened cells. This same variety of epithelium is formed in the pelvis of the kidney, ureter, and bladder.

The mucous membrane throughout the urethra is richly supplied with glands and follicles.

The glands of Littré lie beneath the mucous membrane in the meshes of the corpus spongiosum and are true glands, lined with secreting epithelium and provided with a duct which empties upon the free surface of the urethral mucous membrane. They are very numerous, and are arranged in groups together.

The follicles of Morgagni are simple crypts or depressions of the urethral mucous membrane, and are located upon the roof of the canal.

CHAPTER III.

ACUTE URETHRITIS.

ACUTE urethritis may be divided into **three varieties**:—

(a) An aseptic catarrh, in which no micro-organisms are present and which is due entirely to chemical irritation.

(b) Non-gonorrhœal or **simple urethritis,** which is occasioned by inoculation of the urethral mucous membrane with pyogenic bacteria (staphylococci, streptococci, bacterium coli, or pseudo-gonococci).

(c) Specific or **gonorrhœal urethritis,** which is produced by the gonococcus of Neisser.

Among the **predisposing causes** to any variety of urethral inflammation may be mentioned a damaged condition of the urethra from previous disease which has left behind granulations, erosions, or a stricture; anatomical abnormalities, such as a long and narrow prepuce, a wide urethral orifice, and hypospadias; certain diathetic states, such as gout, rheumatism, and tuberculosis, which predispose to inflammation by lowering the resisting power of the body to bacterial invasion.

An aseptic catarrh of the urethral mucous membrane may be artificially caused by injecting the canal with a solution of nitrate of silver. The irritation and discharge last from twelve to forty-eight hours, and subside spontaneously.

Another variety of the aseptic catarrh occurs in persons of a gouty diathesis, and may be designated as a *uric acid urethritis.*

It is a purely irritative inflammation, and is caused by the sharp points of the crystals when present in the urine in quantity. Under the administration of citrate of potash and large draughts of water to neutralize the urine, it promptly disappears.

NON-GONORRHŒAL OR SIMPLE URETHRITIS.

Any of the pus-producing bacteria—*i.e.,* staphylococcus, streptococcus, etc.—will excite a catarrhal inflammation, with suppuration, of the mucous membrane, if introduced into the urethra. The micro-organisms may be introduced from without, through sexual intercourse, and are contained in menstrual discharges, leucorrhœa, secretions from an ulcerated cervix, and utero-vaginal discharges of any character. They may also be introduced upon a dirty sound or catheter. On the other hand, the bacteria may lie dormant and unsuspected in the patient's own urethra, concealed in the crypts and follicles or the folds of mucous membrane, and may be lighted into activity through overindulgence in alcohol, intense erotic excitement, excessive coitus, or traumatism produced by the passage of a sound.

After an attack of gonorrhœa, a damaged condition of the urethra is often left, which affords a favorable ground for the growth of bacteria other than the gonococcus.

As a result of uncleanliness and balanitis, the organisms enter the urethra through the meatus; or in cases of obstinate constipation they make their way into the blood-circulation from the rectum, are discharged with the urine, and are deposited in the diseased spots in the urethra. Here they find a favorable culture-medium in the pus which is present, and can lead to the same complications of prostatitis and epididymitis which occur in a true gonorrhœa.

In general, however, the inflammatory process in a simple urethritis is less severe than in the gonorrhœal form, and it is limited to the mucous membrane, without involving the submucous tissues.

I. PSEUDO-GONOCOCCIC URETHRITIS

begins insidiously after a longer period of incubation than true gonorrhœa. There is but little discharge, slight tendency to involve the posterior urethra, and no sequelæ. A cardinal feature is the marked tendency to recurrence. The organism is probably identical with Heimann's pseudo-gonococcus and Pfeiffer's micrococcus catarrhalis. It occurs in pairs, of which the members are unequal in size. It is generally extracellular and decolorizes by Gram's method.

The resemblance to the true gonococcus makes the diagnosis difficult. The only way in which a positive diagnosis can be made is by growing the organism. It will grow on ordinary media, in the form of white opaque colonies, as well as on blood-serum agar. The fact that the true gonococcus refuses to grow on ordinary media serves to distinguish the two organisms.[1]

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[1] J. C. Johnston, Journal of Cutaneous and Genito-Urinary Diseases, September, 1902.

In actual practice, a urethritis characterized by the presence of diplococci which decolorize by Gram's method is almost invariably due to infection with the true gonococcus of Neisser. Nevertheless, the possibility of the existence of the pseudo-gonococcus should be borne in mind, as otherwise the faith of a husband in the chastity of his wife or of a lover in the exclusiveness of his mistress may be unjustly destroyed.

II. STAPHYLOCOCCIC AND STREPTOCOCCIC URETHRITIS.

The inflammation caused by the introduction of these organisms into the urethra has often a longer incubation period, but runs a shorter and less severe course than a true gonorrhœa, and is not liable to have any complications.

While this statement is true of the vast majority of cases, Waelsch[1] and Galewsky[2] describe a urethritis characterized by a long incubation period, very slight subjective and objective symptoms, and an exceedingly chronic course, lasting in some cases four or five years.

In some of the reported cases, no organisms whatsoever were found; in others, streptococci, a milk-white diplococcus, and a slender bacillus were present, but the gonococcus was absent in every instance.

TREATMENT.

The treatment of simple urethritis consists in hygienic measures, rendering the urine bland, and the use of a mild astringent injection which answers very well for the light cases. If irrigations are used, the nitrate of silver (1 in 4000) frequently causes a prompt subsidence of the discharge, because the micro-organisms do not penetrate deeply into the tissues, but grow on the surface of the mucous membrane. Here the irrigation of nitrate of silver comes in direct contact with them and destroys them, and at the same time causes a desquamation of the superficial cells upon which the germs have proliferated. One or two irrigations may succeed in ridding the tissues of micro-organisms and infiltrated epithelial cells.

This statement does not apply to the cases described by Waelsch, which are exceedingly obstinate and do not appear to respond to any form of local treatment. Galewsky believes that better results are obtained from the use of the balsams internally than from irrigations, used alone or combined with dilatations.

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[1] Prager, Med. Wochenschrift, 1901, No. 43.

[2] Centralblatt f. Harn. and Sexual Organs, 1903, No. 14.

In the last few months the introduction of *oxycyanat of mercury* into urological practice has given us an efficient antiseptic for irrigating the urethra.

It is regarded as the sovereign remedy for all septic conditions except those caused by the gonococcus, and destroys most organisms when used in the strength of 1 to 4000, which does not irritate the urethra or bladder.

By using it before passing a sound or catheter, it is possible to sterilize the urethra to a large extent, and in cases of simple urethritis its use is to be preferred to nitrate of silver on account of its unirritating qualities. Bichloride of mercury, 1 in 20,000, is also very useful in destroying the staphylococcus in the urethra.

GONORRHŒA.

Gonorrhœal inflammation of the urethra is caused by the **gonococcus of Neisser.** The period of incubation is usually from four to seven days, but in rare instances may extend to fourteen days.

PATHOLOGY.

The gonococci are introduced into the urethra, usually in utero-vaginal secretions or upon an infected instrument. They do not remain upon the free surface of the urethral mucous membrane, but rapidly penetrate between the epithelial cells, and are to be found in the submucous connective tissue itself. They increase and multiply in colonies, in the interepithelial spaces and upper layers of the submucous connective tissue, and the toxic substances which they produce cause reaction on the part of the tissues, which is characterized by dilatation of the blood-vessels and discharge of serum and leucocytes. The cylindrical epithelium cells lining the urethra are loosened by the flow of secretion and are desquamated, forming **erosions** of the epithelial surface.

An active process of **phagocytosis** takes place, by which the gonococci are taken into the pus-cells and thus removed from the tissues, and, in cases which run a normal course, the gonococci have almost entirely disappeared from the submucous connective tissue and deeper layers of the mucous membrane by the end of the second or third week.

When the *stage of decline* commences, the epithelial erosions begin to undergo repair, by being covered with squamous epithelium in many layers. The gonococci which have been removed from the deeper tissues now begin to grow luxuriantly on the free surface of the mucous membrane after the manner of a sod of grass, and a desquamation of the upper layer of the newly-formed epithelial cells takes place, carrying with them their attached colonies of gonococci.

In normal and ordinary cases the process of getting rid of the gonococci is accomplished in the *ascending stage* by *phagocytosis*, and in the *stage of decline* through *desquamation* of the *epithelial cells;* so that in the fifth or sixth week, in favorable cases, the gonococci have disappeared entirely from the urethra, and the inflammation ceases.

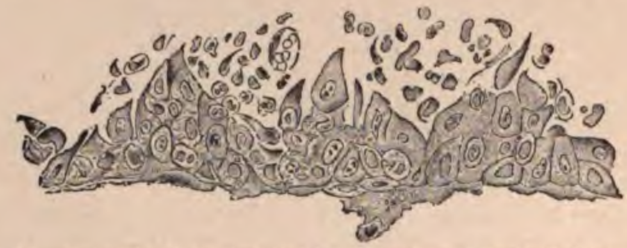

Fig. 15.—Gonorrhœal Conjunctivitis. Invasion of Epithelial layer by Gonococci, and desquamation of the superficial layers of cells.

Morgagni's crypts and Littré's glands are also affected by the inflammatory process, which occurs *within* their cavities as well as around them, and the cavities of the glands act as foci of suppuration and incubating places for gonococci for months after the inflammation has ceased on the free surface of the mucous membrane. An **infiltration of small round cells** which are derived from a proliferation of the fixed connective-tissue cells, and from leucocytes which have escaped from the capillaries, occurs as part of the process of inflammation, and may be **(a) superficial,** or confined to the mucous membrane and its connective-tissue layer immediately underneath, and dipping down and surrounding Morgagni's crypts and Littré's glands, or may be the **(b) deep form,** in which, in addition to affecting the mucous membrane and glands, the small round-celled infiltration involves the *deeper* submucous tissues, extending into the spongy tissue of the corpus spongiosum, in severe cases. The crypts and follicles are usually surrounded by and imbedded in the small round-celled infiltration.

Healing of the lesions is brought about by a removal from the tissues of the gonococci, through (*a*) phagocytosis, and (*b*) desquamation of the epithelial cells, which have been invaded by the gonococci. When the gonococci have been entirely removed suppuration ceases.

The *erosions* either (*a*) become covered with squamous epithelium in many layers, which offers a barrier to the renewed invasion of the tissues by gonococci, or (*b*) the erosions remain without being covered by squamous epithelium, but become the seat of *granulations,* and occasion a gleety discharge.

The *small round-celled infiltration* (*a*) disappears by absorption, especially when superficial and confined to the mucous membrane, and the urethra becomes healthy, soft, and flexible, or (*b*) the small round-celled infiltration is *not* absorbed, especially when deep-seated, —*i.e.,* involving submucous tissue and cavernous tissue of the corpus spongiosum,—but becomes *transformed* into *true fibrous connective* tissue, called *stricture.*

Relapses are frequent, and are due to reinfection of the submucous tissues from a focus of suppuration located either in (*a*) Morgagni's crypts or Littré's glands, (*b*) the seminal vesicles, or (*c*) Cowper's glands or the prostatic crypts.

The manner in which a relapse takes place is as follows: If premature coitus or an excess of beer is indulged in, hyperæmia of the mucous membrane, with increased secretion, follows and the protecting layer of squamous epithelium is torn asunder. The gonococci penetrate through these clefts into the deeper tissues and again cause their irritative symptoms.

If the gonococci remain in the urethra for a considerable length of time a state of tolerance of the tissues is established and with each successive relapse the inflammatory reaction becomes less and less until, with the third or fourth relapse, the energy of reaction is not enough to bring the gonococci out of the submucous tissues. As a consequence, the gonococci remain and give rise to a permanent irritation of the submucous connective tissue, an infiltration of small round cells occurs, and the gonorrhœa becomes *chronic.*

COURSE.

The inflammation begins at the meatus, and in *favorable* cases **affects the *anterior* urethra** only, stopping at the cut-off muscle.

Stages.—*Prodromal.*—The symptoms are a slight tickling at the meatus, and a light-bluish sticky discharge with some slight stinging on urination. These last a couple of days, and then begins the *increasing stage:* The amount of pus increases. It is creamy yellow in color or greenish yellow from admixture with blood. Hæmorrhages may occur. The pain on urination is intense, and is occasioned by the sudden distension of the infiltrated walls of the urethra by the outflow of urine. Neuralgic pains in the back, perineum, groin, and spermatic cord are present. Constitutional disturbance in the shape of fever and a feeling of prostration often occurs. The prepuce may become œdematous and cause phimosis or paraphimosis.

Chordee is of frequent occurrence. It consists in an erection of the penis, with a painful incurvation downward. It is caused by an infiltration into the spongy tissue of the corpus spongiosum which surrounds the urethra and renders it rigid and inextensible. On account of the rigidity of the urethra the stream becomes small and twisted, and dribbling after urination occurs.

This condition continues without change for the better for about three weeks, and during this time it is known that the gonococci have been proliferating in the submucous tissues. At the moment when the gonococci have been removed from the deep tissues and begin to grow upon the free surface of the mucous membrane, the acute symptoms subside, and usually in the course of the third week the *stage of decline* begins. The pain on urination and the chordee lessen, the discharge becomes more watery and less in quantity, until it finally diminishes to a drop in the morning, which ultimately disappears.

Endoscopic examination, or the introduction of any instrument, should be strictly avoided in the acute stage. But if an endoscope were used, the appearances would be as follows:—

The mucous membrane appears swollen, œdematous, intensely red, and covered with pus. The glands and follicles are very markedly affected. The mucous membrane around their openings is more swollen and the openings themselves gape. Erosions, from desquamation of the cylindrical epithelium, appear in the vicinity of the glands. Granulations may form upon the erosions, later in the course of the disease. The submucous tissue is infiltrated, rendering the canal swollen and rigid.

Examination of Urine.—The two-glass urine test should be made at each visit to determine:—

(*a*) If the *posterior* urethra has been affected.

(*b*) The amount of pus secreted.

The urine passed into a glass appears turbid from admixture with pus, and little clumps or masses of desquamated epithelium are present. After standing, the pus settles to the bottom of the glass, and a cloud of mucus appears floating above it. As the case goes on toward recovery the pus disappears, but the hypersecretion of mucus continues, and occasions a cloudy appearance in the urine, resembling mucilage added to it.

After the mucus disappears *clap-shreds* persist for months, showing that *isolated portions* of mucous membrane are ***not covered*** with *epithelium*, and are ***still secreting pus.***

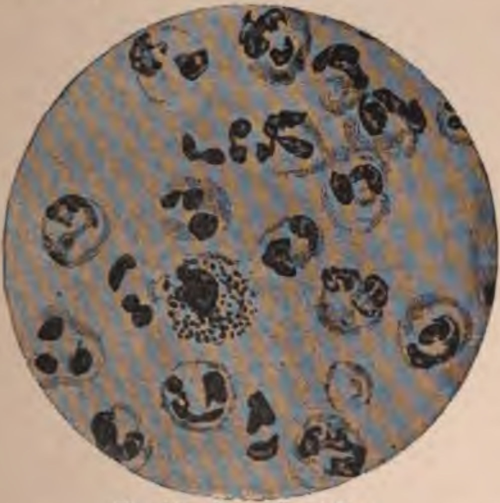

Fig. 16.—Gonorrhœal Pus.

Microscopic Examination of Pus.—In the ascending stage numbers of pus-cells are present containing gonococci *within* the cell. In the *stage of decline* a diminution is noted in the number of pus-cells, fewer gonococci are present, and squamous epithelial cells make their appearance. Finally the pus-cells and gonococci disappear, and squamous epithelium alone is found.

It is of the *utmost importance* to make sure of the entire disappearance of all gonococci before permitting coitus, on account of the danger of infection, in case the gonococci are not removed.

If no purulent discharge is obtainable from the meatus it is proper to excite a simple urethritis, by injecting the urethra with nitrate-of-silver solution, gr. x to the ounce.

If gonococci are lurking in the crypts or a granular patch, the suppuration caused by the injection will bring them to the surface, and they can be found by microscopic examination of the discharge.

MORPHOLOGY OF THE GONOCOCCUS.

The gonococcus resembles in appearance two coffee-beans placed side to side, and, as it is removed by phagocytosis from the tissues, will of necessity be found lying *within* the pus-cells. A few gonococci may be found outside the pus-cells, if these have been ruptured. In the descending stage of gonorrhœa the gonococci are found adherent to and growing upon the desquamated squamous epithelial cells.

Other micro-organisms—for example, the pseudo-gonococcus—which are not pathogenic resemble the gonococcus in shape, but it is believed to-day that the gonococci can, in the great majority of cases, be recognized by decolorizing them by Gram's solution.

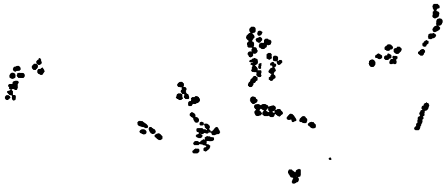

Fig. 17.—Gonococci Growing in Clusters.

The microscopic examination for the gonococcus is pursued as follows in the Hoagland Laboratory, after the method of A. Hymans Van den Bergh:—

In the microscopic examination for the gonococcus it is well to have two smears of the pus on cover-glasses. One of these is stained with methylene blue, and if organisms are found which resemble the gonococcus, the second smear is stained by Gram's method to confirm the diagnosis.

Preliminary staining:—

1. Make a thin smear on a cover-glass, of the pus supposed to contain the organisms.

2. Dry in the air and fix by passing three times through the flame, rapidly.

3. Stain for one minute in Löffler's solution of methylene blue (prepared by Eimer and Amend).

4. Wash in water, dry, mount in balsam, and examine with a one-twelfth oil-immersion.

The gonococci are found on examination to be stained blue.

In order to differentiate the gonococci from other organisms present which may resemble them, the second smear is stained by Gram's method, as follows:—

1. Stain in aniline-water gentian-violet for one minute.
2. Remove stain by blotting; do not wash.
3. Place in Gram's solution for one minute.
4. Blot, and decolorize in absolute alcohol until the smear is of a light grayish color.
5. Dry and stain with Bismarck-brown for one or two minutes.
6. Wash in water, dry, and mount in balsam.
7. Examine with one-twelfth oil-immersion.

When this method is used the gonococci are decolorized, the other organisms present remaining a purplish-black color.

In order to bring the decolorized gonococci into view, the smear can be counter-stained with Bismarck-brown, which stains the gonococci brown, the other organisms remaining a purplish-black color.

Formulæ.—To make aniline-water, shake up 5 cubic centimeters of aniline-oil in 100 cubic centimeters of plain water. Shake violently, and filter through a wet filter.

Gentian-violet.—To 1 cubic centimeter of saturated alcoholic solution of gentian-violet add 20 cubic centimeters of aniline-water.

These added together make aniline-water gentian-violet, which does not keep, as a mixture, more than a week.

Gram's Solution.—Iodine crystals, 1 gramme; potassium iodide, 2 grammes; water, 300 cubic centimeters.

Other micro-organisms, the pseudo-gonococcus, for example, resemble the gonococcus of Neisser in form, and the differential diagnosis is made by using *Gram's method of staining.*

If the organism decolorized, it was formerly considered an absolute proof that it was the gonococcus of Neisser. If, however, it did not decolorize, it was thought that we had to deal with the pseudo-gonococcus.

The absolute reliability of the Gram test has been somewhat shaken by later observations, for it is now known that a few other organisms will also decolorize by Gram.

Steinschneider and Galewsky have found, however, that the Gram test can be depended upon in 95½ per cent. of the cases.

It is believed to-day that the only way to determine the character of a suspected organism is to make a culture.

The growth of the organism on blood-serum agar or similar culture media, and its failure to grow on ordinary agar, glycerine agar, and gelatine, proves absolutely the organism is the true gonococcus of Neisser.

DURATION OF AN ATTACK OF GONORRHŒA.

When the posterior urethra is not affected a favorable case of gonorrhœa recovers in six to eight weeks. In very exceptional instances recovery may occur in three to four weeks, but in these cases there is always a doubt as to the correctness of the diagnosis of true specific gonorrhœa, although under the modern treatment with silver albuminate salts the duration is materially shortened.

The first attack is the most severe, but most liable to recover without stricture. Later attacks are apt to follow the course of the first one, in having a repetition of the complications.

The virulence of the cultures of the gonococcus seems to differ materially.

It is often noted that when an individual has had chronic gonorrhœa for months or years, that the gonococci when transplanted into the tissues of another person are not capable of producing such virulent inflammatory symptoms, as if taken from a fresh case.

This attenuated virulence would seem to explain the fact that in such cases the period of incubation is comparatively long, the purulent discharge is scanty, and the cases often become chronic, resulting in stricture and prostatitis. This course and termination are probably due to the fact that the irritation is too slight to cause enough phagocytosis to rid the tissues of the invading organisms.

Another condition which influences the prognosis in gonorrhœa is the state of the patient's general health.

Gonorrhœa acquired by an individual affected with phthisis or general debility is apt to run a subacute but exceedingly protracted course.

The causes which retard recovery may be grouped as follows:—

(*a*) Complications, posterior urethritis, prostatitis, etc.

(*b*) Reinfection from a urethral gland, seminal vesicle, prostate, etc.

(*c*) Lack of rest.

(*d*) Habits of drinking.

(*e*) Injections which are too strong or too frequently repeated.

(*f*) Constitutional causes: *i.e.*, gout, tuberculosis, etc.
(*g*) Premature coitus.

PROPHYLAXIS.

To avoid acquiring gonorrhœa, coitus should not be too prolonged and should be limited to a single act, and the man should urinate immediately afterwards to wash away any vaginal secretion which may have gained access to the urethra. This is by no means infallible, and in spite of such precautions infection very frequently occurs.

Finger advises the use of a condom, which is in no way injurious, and unless accidentally ruptured during coitus is a perfect safeguard against infection or impregnation.

Since the introduction of the albuminates of silver, a remedy has been placed in our hands which affords a reliable means of preventing gonorrhœal infection.

Frank,[1] of Berlin, made experiments on six men into whose urethræ gonorrhœal pus was artificially introduced.

Three of these received a prophylactic instillation of 3 to 5 drops of a 20 per cent. solution of protargol dissolved in glycerine. The others were not so treated.

The three patients who did not receive the prophylactic instillation developed gonorrhœa and the other three escaped. The experiment was repeated with the same result.

Kopp, Zeissl, and others have made similar experiments and confirm Frank's observations.

Since the introduction of albargin, Frank uses a 5 per cent. solution of this salt in glycerine, on account of its comparatively unirritating qualities, with the same results.

All the observers agree that the prophylactic instillation, if used immediately after coitus, will destroy any gonococci which may have entered the urethra, without causing any damage to the tissues.

TREATMENT.

Gonorrhœa is a *self-limited* disease, and the suppuration may be looked upon as an effort on the part of the tissues to remove the invading micro-organisms; so that when the last gonococcus is removed suppuration ceases, unless post-gonorrhœal lesions in the urethra and infection with other bacteria cause a catarrhal inflammation with secretion, and a discharge of pus continues.

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[1] Allg. Med. Central. Zeitung, 1899, No. 5.

An expectant plan of treatment can only be carried out exceptionally, as in military hospitals, for instance. Here it is found that if a patient with gonorrhœa is put to bed and fed on a bland diet, consisting chiefly of milk, in forty-five days, on an average, the gonococci are eliminated from the tissues and the suppuration has ceased. Under the existing social and business conditions, however, such a plan of treatment is practically impossible, and we have to adopt the methodic treatment.

As the gonorrhœal inflammation begins at the meatus and does not reach the posterior urethra until the third week, or in favorable cases not at all, we will first consider the treatment of inflammation which is limited to the anterior urethra, and take up posterior urethritis in a subsequent section.

From the earliest times many efforts have been made to abort the course of a gonorrhœa by using strong injections or pencilings of nitrate of silver and other caustics.

These attempts were all failures and the increased irritation reacted most injuriously upon the course of the gonorrhœa. Since the introduction of the albuminates of silver, **an Abortive Treatment** has been suggested which is sometimes successful. The favorable cases are those which present themselves for treatment a few hours after the discharge is first observed and in which the *microscope shows leucocytes, much epithelium, and gonococci which are extra-cellular.* Such cases can often be cured in six or eight days if treatment is begun at once. (Wossidlo and Frank.)

If the gonococci are very abundant and the case is three or four days old, the attempt may be made, but the outlook is not very good.

The method of applying the abortive treatment consists in irrigating the anterior urethra once a day with a 1 to 1000 albargin solution, either with an irrigator with hydrostatic pressure or a large hand-syringe provided with a rubber tip.

Wossidlo prefers to use the large syringe. Its tip is placed within the meatus and the urethra *rapidly* distended with the solution, which is at once allowed to run out. The sudden impact of the fluid causes the vesical sphincter and deep urethral muscles to contract energetically and prevent the fluid from entering the bladder. A pint of the solution is used at each sitting.

After the first injection the discharge is increased for a few hours, but in successful cases it becomes scant, slimy, and free from gonococci in from two to four days.

Gonosan is given internally and the patient uses albargin as a hand injection once a day.

After five or six days, if the patient seems cured, a provocative injection with silver nitrate is made, to make sure that no gonococci are present.

Of 122 cases reported by Zenzes, 61 were cured within a few days.

If the pus continues, but the gonococci have disappeared, permanganate irrigations are useful in diminishing the discharge.

If after four or five days of this treatment it is evident that the disease cannot be cut short, it must be treated as an ordinary case of gonorrhœa.

ANTERIOR URETHRITIS.

Methodic Treatment.—There are certain **hygienic** directions which the patient should observe: he should keep quiet and spend as much time lying on a sofa or bed as possible, and should, of course, avoid all sources of sexual or erotic excitement. He should be warned of the danger of gonorrhœal ophthalmia, and directed to wash his hands after handling the penis or dressings, to avoid carrying any pus into the eyes.

The **diet** should be non-stimulating, and the patient should avoid meat in excess, highly seasoned or salty foods, sauces, condiments, strong tea or coffee, pickles, tomatoes, asparagus, and alcoholic drinks of all kinds, of which beer and champagne are especially detrimental.

Dressings for the purpose of catching the discharge and keeping it from the clothing are always necessary. The best form is made by cutting off the foot of a stocking and placing some absorbent cotton at the bottom; the penis is placed within it and the bag suspended from a waist-band; or the gonorrhœa bag which is sold in the shops answers the same purpose.

Constricting the penis by wrappings should be carefully avoided, so as not to interfere with the return-circulation. If the discharge is but trifling, a pledget of cotton may be placed under a long foreskin to absorb it; but the cotton is not to be recommended if the discharge is profuse, as it will prevent the pus from flowing out freely from the meatus, and cause it to dam back.

A *suspensory bandage* should be worn in every case to relieve the sensation of *dragging* on the spermatic cord and perhaps lessen the danger of epididymitis.

Therapeutic Treatment.—The *balsams* of copaiba, cubebs, and sandal-wood oil have had for years a well-deserved reputation as anti-blennorrhagics. They are eliminated by the kidneys, and affect the inflamed urethra as they pass over it, held in solution in the urine.

Sandal-wood is best adapted to the increasing stage, but acts well throughout the whole course of the disease. It may be combined advantageously with fl. ext. of kava kava in 5-minim doses in capsule. This combination is known as *Gonosan*. The balsams of copaiba and cubebs have fallen largely into disuse, but are sometimes serviceable in the descending stage of a gonorrhœa.

The dose of sandal-wood oil and the balsams is from 10 to 20 drops in capsules, three times a day.

Sandal-wood oil sometimes causes an intense pain in the back, or disagrees with the digestion, and has to be abandoned on these accounts, while copaiba often causes an erythematous eruption resembling measles.

While sandal-wood oil and the balsams are useful adjuvants in gonorrhœa, it is necessary to have recourse to other measures to effect a cure.

Treatment of the Increasing Stage.—The bowels should be regulated by a saline cathartic given every second morning before breakfast, which depletes the pelvic blood-vessels and lessens congestion, and prevents the migration of the colon bacillus from the rectum to the urethra.

Alkalies or an alkaline mineral water should not be prescribed as a routine measure, for an alkaline reaction of the patient's urine is always caused by his abstinence from meat and his free use of milk, and the best prophylactic against the development of cystitis in gonorrhœa is a strongly *acid reaction* of the urine, which inhibits the growth of any bacteria which may find their way into the bladder.

Diluents.—The patient should be directed to drink considerable quantities of pure distilled water—a glass every hour or two, with the object of *washing out* the urinary passages and keeping the urethra free from secretions which would otherwise form excellent culture-media for gonococci.

Sandal-wood oil is administered by the mouth, preferably in capsules. The well-known Lafayette mixture is commonly used in hospital and dispensary practice, but it has the disadvantages of containing an alkali and of having an abominable taste. Its formula is as follows:—

℞ Extracti hyoscyamus fluidi	fʒss.
Potassii citratis	℥j.
Olei santali flavi	f℥ss.
Aquæ destillatæ	f℥ij.
Syrupi acaciæ	q. s. ad f℥vj.
Olei gaultheriæ	fʒss.

M. Sig.: Two teaspoonfuls at a dose.

The *burning* on *urination* is lessened in some degree by the sandal-wood oil, but if very severe can be relieved by injecting ʒss of 4-per-cent. cocaine solution into the urethra.

The local treatment by means of *astringent injections* is *entirely contra-indicated during the ascending stage,* for, as we have already noted in considering the pathology, the gonococci at this time are in the upper layers of the *submucous connective tissue* and the *deeper cells* of the mucous membrane, and they are being removed from the deeper tissues as rapidly as possible by the phagocytic action of the leucocytes. Under these conditions the action of an astringent is to hinder the elimination of the gonococci from the depths, and so retard the natural healing process.

A pure antiseptic, however—such as some of the new silver salts—is entirely in order, and is effectual in moderating the severity and shortening the duration of the disease.

The indications for the cure of gonorrhœa as formulated by Neisser are as follows:—

1. Destroy the gonococci in all foci within reach as early and completely as possible.

2. In doing so, avoid irritation of the mucous membrane, any exacerbation of the existing inflammation, and everything which has a caustic action on the tissues and all unnecessary pain.

The former plan of refraining from all local treatment in the ascending stage of a gonorrhœa was only to be advised when no remedies existed which would destroy the gonococcus.

In the last few years, however, modern chemistry has provided us with a group of drugs which actually accomplish the conditions demanded by Neisser, and destroy the gonococci without injury to the mucous membrane.

They consist in a combination of silver with bodies from the albuminous group, are soluble in water, and not precipitated by contact with salt or albumin. They are accredited with the power of penetrating the deeper tissues and destroying the gonococci which lie underneath the mucous membrane.

The action of the silver salts is incomplete, and they do not destroy *all* the gonococci, particularly those in the mucous crypts and follicles; so that if their use is discontinued too soon, a relapse is liable to occur.

A great advantage of the treatment with silver salts, which may also be assisted by the internal use of sandal-wood oil, is that the disinfection of the tissues advances rapidly and the spread of the inflammation is checked; so that, while under ordinary treatment posterior urethritis occurs in 80 per cent. of the cases, in the patients treated with silver salts posterior urethritis is observed in from only 30 to 40 per cent. of cases, and the disagreeable symptoms of excessive discharge, chordee, and burning on urination are very much lessened.

In point of time, while a small percentage of cases are cured in from two to three weeks, under the treatment with silver salts, in the great majority of patients, in which complications do not occur, a continuous course of medication of five to six weeks is required, in order to effect a cure.

As the albuminates of silver all possess similar properties, albargin, protargol, and argyrol may be taken as types of the entire class.

These drugs may be regarded as pure antiseptics without astringent properties, and entirely unirritating to the tissues, so that they can be used in the ascending stage.

METHOD OF USING THE SALTS OF SILVER.

It should be borne in mind that the local treatment of acute gonorrhœa is only admissible when no complications, such as severe posterior urethritis, suppurative prostatitis, vesiculitis, etc., are present.

In an uncomplicated case, the injections with the salts of silver may be begun at once, in the ascending stage.

The patient should be instructed that it is important to make the injections from six to eight hours apart, and before using the injection he should urinate. It may sometimes be advisable to wash out the urethra with a couple of syringefuls of warm water, to prevent any

albargin Meister Lucius & Brüning
.2 gr. Eu. dd
: 3 grain.

action of the urinary salts upon the silver solution, and also to cleanse the walls of the canal.

The solution of silver should be held in the urethra from five to ten minutes, in order to exert its destructive action upon the gonococci. A shorter time is insufficient and fails.

Protargol should be used in the strength of 1 to 4 grains in the ounce; argyrol, 9 to 22 grains to the ounce; and albargin, which is the most concentrated and is at present preferred in Germany, in the strength of 1/4 to 1 grain to the ounce, and 1 to 1000 in solution for irrigations.

The weaker solutions are used at first, and the strength is increased by degrees.

In using an injection the fluid must come in contact with the entire mucous membrane of the urethra and it must distend the bulb. The folds of the urethra must also be distended and the fluid should also press into the openings of Morgagni's crypts. To accomplish these objects the syringe must have a capacity of at least 4 drachms, but Frank and Finger prefer to use an irrigator with a copious flow acting by hydrostatic pressure, as it is very difficult to distend the bulb sufficiently and force the fluid into Morgagni's crypts with a hand-syringe. (See Janet irrigation.)

Under the use of one of the silver salts as an injection, in the course of a few days the acute symptoms subside and the pain on urination and chordee disappear. It should be noted that, if treatment be discontinued at this point, even though the discharge has ceased and only a few shreds remain in the urine, a relapse is certain to occur in from two to three weeks, for a few gonococci have been left which were not destroyed, and reinfection occurs.

With the subsidence of the acute symptoms the strength of the solution should be increased, and it may be used four times a day, in order to destroy the gonococci more rapidly.

Another advantage possessed by protargol, argyrol, and albargin is that, in cases where the inflammation has passed beyond the cut-off muscle and attacked the posterior urethra, on holding a solution of either drug in the urethra for a short time the cut-off muscle relaxes, on account of the mild and unirritating character of the remedies, and allows the solution to flow back and come in contact with the posterior urethra and exercise its bactericidal power.

If a strong and irritating solution, like nitrate of silver, is injected into the anterior urethra, a reflex contraction of the cut-off muscle is always caused.

In a severe case of posterior urethritis any injection is inadmissible, but the very mild form without symptoms need not be regarded as a contraindication to local urethral medication.

Under the treatment with silver salts above described, in cases which run a favorable course, in about three weeks the discharge has become thin, watery, and scanty, and microscopic examination shows few or no gonococci, but many newly-formed desquamated epithelial cells.

ASTRINGENT INJECTIONS.

Our task is now to cure the existing post-gonorrhœal lesions, which consist in a catarrhal inflammation of the mucous membrane, erosions, periglandular infiltration, and soft infiltration of the submucous tissues.

As the silver salts have only a destructive action on the gonococci, but no effect upon the inflammatory process, it is necessary at this time to treat the existing catarrh in the mucous membrane by some remedy with an astringent action, but as there are usually a few gonococci still remaining, often hidden in Morgagni's crypts, it is necessary to continue the antibacterial silver salt in combination with an astringent.

The silver salt should be injected twice a day, and one of the following drugs used twice a day, at a different time, as an injection:—

℞ Zinci sulphatis	gr. xij.
Resorcin	gr. xxiv.
Aquæ	℥iv.

Ultzmann's Injection:—

℞ Zinci sulphatis	gr. iv to xij.
Pulv. aluminis	gr. iv to xij.
Acidi carbolici	gr. iv.
Aquæ	℥iv.
℞ Zinci permanganatis	gr. j to gr. ij.
Aquæ	℥iv.
℞ Zinci sulphatis	gr. xv.
Plumbi acetatis	gr. xxx.
Aquæ destillatæ	q. s. ad ℥vj.

Sig.: Insoluble. Hold in urethra, and let out drop by drop.

Syringes are of various shapes and made of soft rubber, hard rubber, and glass. An important point to observe is that the nozzle

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is not prolonged into a snout, which would irritate the mucous membrane of the fossa navicularis. In addition, it is essential that the syringe should hold from three to four drachms of fluid, so that when the injection is given the folds of the urethra may be fully distended.

Technique of Injecting.—The patient urinates to cleanse the urethra, and then, holding the penis in the left hand, draws it out, while with the right hand the injection is slowly forced from the syringe into the urethra and held for two to five minutes. It is not necessary to make pressure on the perineum to keep the fluid from entering the bladder, as the fluid is kept from flowing backward by the tonic contraction of the cut-off muscle.

An astringent injection should never be used in the presence of posterior urethritis nor in the *ascending stage* of a gonorrhœa, for until the stage of decline sets in the gonococci lie deep within the tissues and entirely out of reach of astringents applied to the surface of the mucous membrane. In addition to being of no value in destroying the gonococci, astringents are actually harmful from the irritation which their use entails.

In the *stage of decline*, however, when the burning on urination is decreased and the discharge has become thin and watery, the gonococci are growing upon the free surface of the mucous membrane and can be destroyed by the application of the various injections which combine an antiseptic and astringent. At the same time the dilated blood-vessels are contracted by the astringent and the inflammation, through their agency, is lessened.

An injection should never cause more than a slight burning. After a time the urethra becomes *tolerant* of *one* form of injection, and it is necessary to increase its strength or to change the formula.

After the gonococci have entirely disappeared from the discharge, the silver salt may be discontinued and the astringent injection used alone three or four times a day.

Under this treatment the discharge soon stops and the urine becomes clear and free from pus, but *shreds* are abundant.

When the shreds appear, the urethra should be irrigated with solution of silver nitrate in the strength of from 1 in 10,000 to 1 in 4000.

If a profuse discharge appears afterwards, it indicates that there are still gonococci present in the tissues, and the treatment with the silver salt must be further continued.

When no relapse follows the nitrate of silver irrigation, and the urine is clear but contains many shreds, **Dilatation of the Urethra** should be begun, either with a full-sized steel sound or preferably with Frank's anterior irrigating dilator.

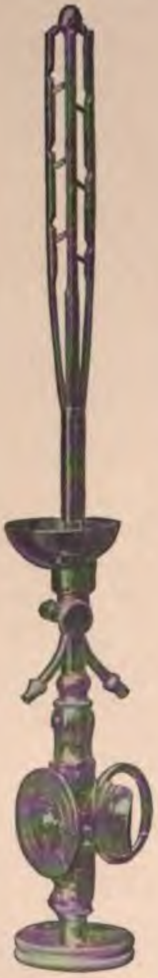

Fig. 18.—Frank's Irrigating Dilator, for the Anterior Urethra.

The dilatations should be made once a week, possibly once in four or five days, beginning with 27, 28, or 30. The amount of reaction and secretion following is a guide to the frequency with which the dilatations may be used.

Each dilatation should be accompanied by an irrigation of nitrate of silver, 1 in 10,000 to 1 in 2000, or icthargan, 1 in 4000; or if staphylococcus, streptococcus, or the colon bacillus is present, oxycyanat of mercury, 1 in 4000, should be used.

Albargin or protargol is not called for at this stage, as the gonococci are mostly removed from the tissues and an astringent is required.

The irrigating dilatations are continued until the shreds are gone and the patient uses a hand injection of one of the astringents three times a day, and a copious irrigation of the urethra should be made every second day with nitrate of silver or icthargan.

Certain individuals do not respond well to this treatment, but improve rapidly under a daily irrigation of icthargan or permanganate of potash. (Wossidlo.) Permanganate of potash is a mild antiseptic and astringent, and often acts very well in checking suppuration, although it has little or no action on the gonococci themselves.

An important question is, how long should the treatment of a gonorrhœa be continued? It is not sufficient to stop medication when the discharge from the meatus ceases, for small quantities of secretion adhere closely to the walls of the mucous membrane, in thin layers, particularly in the bulb; and are only washed off by urination, appearing in the urine as shreds. The presence of shreds always shows that the inflammatory process is still active.

It is possible to treat a gonorrhœa too long, for after the gonococci have disappeared an irritable hyperæmic condition of the mucous membrane is left, which is characterized by the appearance of thin, transparent shreds. The secretion which appears at the meatus causes a slight sticking together of the lips in the morning, or on squeezing, a small, transparent drop like glycerine appears.

If the use of strong injections is continued at this stage, the condition is made worse or the discharge increases and continues as long as the irritating injections are used.

It is always advisable to stop treatment for a time to allow the irritation to subside, and often the thin mucous discharge will spontaneously disappear.

But the question of how long to continue treatment and when to stop, can only be answered by the microscopic examination of the discharge. If gonococci are present, even though few in numbers, the antibacterial treatment must, of course, be continued, and if pus-corpuscles are numerous, even though gonococci are not found, it is evident that a focus of suppuration is present somewhere, very often in one of Morgagni's crypts or one of the para-urethral glands, and a subsequent examination will probably reveal the presence of gonococci.

In such cases the antibacterial treatment should be continued, but when the microscope shows only a small quantity of pus and numerous epithelial cells, treatment should be stopped, as the desquamation of epithelium is only harmfully increased by continuing. (Finger).

After five or six weeks' treatment, if the discharge has stopped and the urine is free from filaments and the prostate and vesicles are not involved, treatment may be suspended, and if a week or ten days passes without symptoms, the patient may be instructed to drink several glasses of beer.

If the beer does not cause a relapse, the patient remains for a fortnight under observation, and the urine is examined for shreds. An irrigation of the anterior urethra with nitrate of silver should be made twice, at different times, to cause an irritation, and the resulting discharge should be examined for gonococci.

If the chemical urethritis following the nitrate of silver ceases spontaneously in forty-eight hours and does not appear again, and the microscope demonstrates the absence of gonococci in the pus, and if the urine remains clear and free from shreds, the patient may be discharged as cured.

Before giving him a clean bill of health, however, it is necessary to examine the urethra with a bulb or urethroscope, and to investigate the condition of the prostate and seminal vesicles, to make sure that these organs are free from disease.

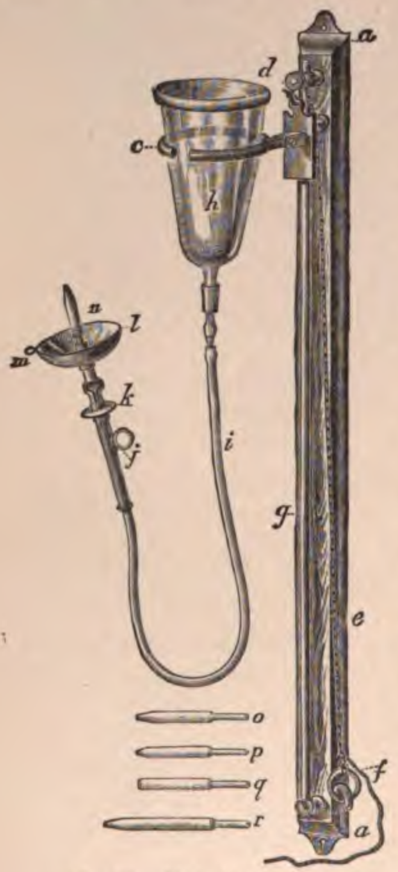

Fig. 19.—Valentine's Irrigator.

Irrigations with Permanganate of Potash: Janet's Method.——A few years ago the treatment of gonorrhœa, suggested by Janet, of Paris, by means of irrigations of permanganate-of-potash solution, was extensively used. Its adherents were enthusiastic in praise of its merits, Goldberg, of Cologne, citing statistics showing that 90 per cent. of the cases of gonorrhœa were cured in fourteen days by this means, but these claims as to its advantages would seem to be extravagant. According to the experience of other men who have used this form of treatment, it is impossible to attain any such results, and most specialists have given up the method in disgust, after a fair trial.

From the author's reading and experience with the Janet method, the following would seem to be a fair estimate of its value:—

The profuse purulent discharge is checked, in most cases, in about eight days; but even under treatment *relapses,* accompanied by a free discharge of pus, occur in nearly every case, without apparent cause, and often several times. These relapses yield promptly to irrigations of permanganate, but the convalescence is retarded, and

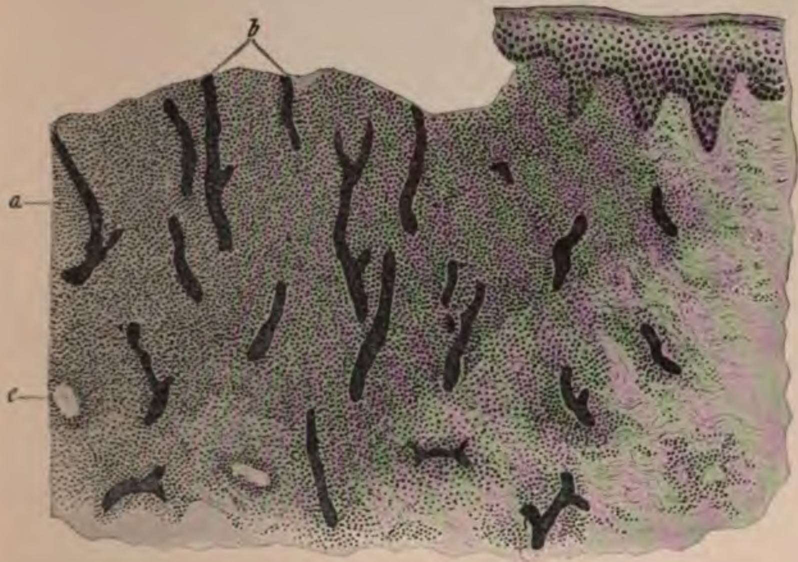

Fig. 20.—Section of Chancroid.

a, Small round-celled infiltration.
b, Lymphatics, open and gaping.
c, Blood-vessel.

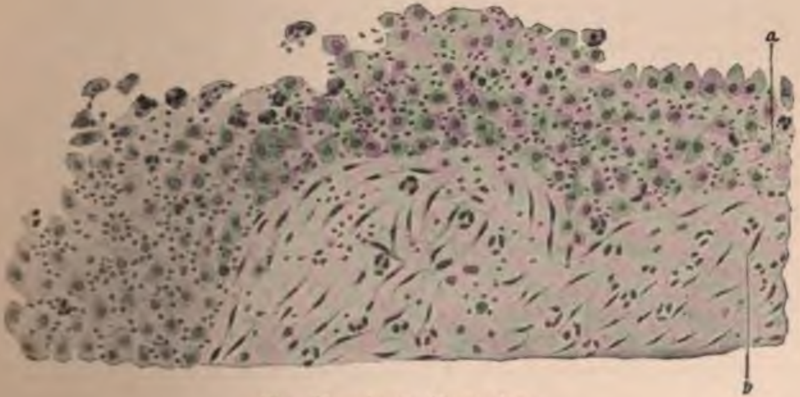

Fig. 21.—Acute Gonorrhœa.

a, Cylindrical epithelium, infiltrated with pus-cells and gonococci.
b, Submucous connective tissue, with pus-cells and gonococci.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

the irrigations have to be continued daily to hold the pus in check and to control the thin, serous discharge which lasts after suppuration ceases. The course of the case is in this way dragged out; so that at least one month, and very often two months or more, are required to effect a cure.

The *advantages* of the method are that posterior urethritis is of exceptional occurrence. The discharge from the meatus is so slight as not to cause any inconvenience, and there is no burning on urination and no chordee.

The *disadvantages* of the Janet method are the expense, trouble, and inconvenience entailed upon the patient by being obliged to report at his physician's office once or twice a day for treatment.

The objection which has been raised, that the frequent irrigation of the bladder or the relaxation of the cut-off muscle will in time do harm, is, I believe, entirely unfounded.

Technique.—The patient sits easily, well forward on a chair, and rests his back against the back of the chair. The irrigator nozzle is inserted into the meatus and the anterior urethra washed out. If it is desired that the fluid should enter the bladder, the irrigator is elevated to the height of nine feet from the floor. The patient is instructed to take a long breath and attempt to urinate. As soon as the cut-off muscle is relaxed the solution from the irrigator flows into the bladder, and when the bladder is filled the patient stands up and urinates, and the solution flows out through the urethra.

The urethra is irrigated twice a day for the first week, and then once a day till the patient is cured. The first irrigation is used of a strength of 1 to 1000 for its abortive effect, in the anterior urethra alone, and the second time of a strength of 1 to 6000. From this time on the strength of the solution should be 1 to 3000.

As a rule, the first irrigation diminishes the secretion materially, and when after a few days the secretion is scanty in amount and thin, the irrigation is allowed to flow through the posterior urethra into the bladder.

After the first week one irrigation a day is sufficient, and the strength may be increased to 1 in 1500, unless it causes tenesmus and bladder irritation.

The effect of permanganate irrigations is to cause energetic disinfection of the mucous membrane by removing and mechanically washing away accumulated secretions, as is the case with the irrigation of any suppurating wound-cavity. The permanganate also causes an œdematous swelling of the epithelial cells, which inhibits the growth of colonies of gonococci, but does not destroy them.

At the present time irrigations with permanganate of potash in the treatment of an acute gonorrhœa are no longer used, for other and better remedies have taken the place of this drug; but, as Frank points out, we are indebted to Janet for a method of bringing an antiseptic solution, such as one of the silver salts, in contact with all parts of the urethra, distending the folds and bulb and very probably entering into Morgagni's crypts.

This method of irrigating the urethra, preferably with 1 to 1000 solution of albargin, is useful in the acute cases for its abortive effect, but it is especially called for in the treatment of chronic gonorrhœa, after instrumentation of the urethra or massage of the prostate as long as gonococci are present.

After the gonococci have disappeared, but an infection with other organisms is present, the urethra should be irrigated with oxycyanat of mercury, 1 to 4000, or nitrate-of-silver solution, 1 in 10,000. (Frank.)

CHAPTER IV.

POSTERIOR URETHRITIS.

Posterior urethritis consists in an inflammation of the mucous membrane of the posterior urethra, which lies behind the cut-off muscle. In severe cases the inflammation may extend up out of the urethra and involve the base of the bladder.

Acute posterior urethritis is almost always caused by the extension of a gonorrhœal or simple urethritis from the anterior part of the canal; but the *subacute and chronic forms* may be the result of prolonged congestion from sexual abuses, complicated by germ infection from the rectum or from without.

Posterior urethritis is a serious complication of gonorrhœa, because

I. It increases the extent of the inflamed surface and renders recovery more remote.

II. On account of *complications,* which are almost sure to follow, if the pus is conveyed through the various ducts opening into the posterior urethra, to the prostate, seminal vesicles, testicles, and bladder.

Posterior urethritis occurs in 40 to 80 per cent. of cases of gonorrhœa, but is often so mild as to be overlooked. It usually develops from the second to the fourth week, or when the gonorrhœal inflammation has extended to the bulb. It may be excited by the use of a sound or catheter in an acutely inflamed urethra, which pushes the pus along in front of the instrument or causes traumatism, or it may develop spontaneously.

The membranous urethra, in certain cases, acts as a barrier to the spread of an inflammation from the anterior urethra backward toward the bladder. The cut-off muscle, which surrounds the membranous urethra, is in a state of tonic contraction, and acts like a valve, and the mucous membrane lining the membranous urethra is less vascular and provided with fewer crypts and follicles than either the anterior or posterior urethra, and also serves to check the extension of the gonorrhœa.

Clinically two forms of posterior urethritis are met with: **(a) mild or subacute form; (b) severe form.**

SYMPTOMS.

The symptoms of the **mild form** may be so slight as not to attract attention. There is an ill-defined sense of weight over the pubes and a feeling of pressure in the perineum, together with slightly increased frequency of urination.

The symptom of increased frequency of urination depends upon the fact that, in a condition of health, the posterior urethra is the most sensitive part of the canal, and, when the bladder becomes filled and a few drops of urine trickle into the posterior urethra, their presence sets up a certain physiological irritation, which is transmitted to the bladder, and produces a contraction of its muscular walls, which empties the bladder of its contained urine.

In posterior urethritis there is a congested state of the prostatic urethra and an abnormally acute sensitiveness; so that the stimulus to urinate is greatly increased.

In the **severe form** of posterior urethritis the symptom of frequent and painful urination is very much aggravated. If the inflammation is very acute and particularly if it has extended to the base of the bladder, violent vesical tenesmus sets in, which the patient cannot restrain.

The squeezing together of the inflamed surfaces, by the muscular contractions of the bladder, not only causes intense pain, but also often ruptures some of the capillaries in the mucous membrane; so that a few drops of blood generally follow the act of urination.

No sooner has one spasmodic contraction of the bladder subsided than another one sets in, and these continue to recur every few minutes until the suffering becomes almost unbearable.

DIAGNOSIS.

The diagnosis of the **severe** form of posterior urethritis can usually be made from the symptoms alone, but the **mild** form is apt to be overlooked, unless we direct our patient with gonorrhœa to urinate in two glasses, each day we see him, and in this way we can detect inflammation of the posterior urethra in its incipiency.

The **two-glass urine test**, as devised by Sir Henry Thompson, is based upon the physiological action of the cut-off muscle, which, by its tonic contraction, forms a barrier between the anterior and posterior urethra. Fluids injected into the anterior urethra cannot flow back into the bladder, and pus lying in the posterior urethra is prevented from flowing out through the anterior urethra, but escapes backward into the bladder, and renders the urine which had accumulated in the bladder turbid and cloudy.

If suppuration is going on in the anterior urethra (the posterior urethra being healthy), and the patient is directed to urinate, the first gush of urine washes out the pus, and the urine, if caught in a glass, appears turbid. If the remainder of the urine, which had collected in the bladder and is uncontaminated, is passed into another glass, the urine in the *second* glass is clear.

If suppuration is present in *both* anterior and posterior regions of the urethra, the *first* glass of urine passed is, of course, turbid, from the pus washed out of the urethra, and the *second* glass will be ***turbid also,*** because the pus formed in the posterior urethra flowed back and stained the urine which was contained in the bladder.

Turbidity of the urine is sometimes caused by urates or phosphates. If uratic in origin, the cloudiness clears up on boiling, and, if phosphatic in character, a few drops of nitric or acetic acid will render it clear. The presence of pus can be determined by microscopic examination or by adding a few drops of liquor potassæ to the suspected urine, in a test-tube, and twirling it rapidly. If pus is present it will be coagulated and float in long, ropy strings through the urine.

Chemical examination shows more albumin than can be accounted for by the pus. This superabundance of albumin is not occasioned by structural changes in the kidney, but by increased intrapelvic pressure, caused by the frequent and severe muscular spasms of the bladder.

In nearly every case of post-urethritis developing in the course of a gonorrhœa, rectal examination will show that the prostate is more or less affected; and after the inflammation has disappeared from the posterior urethra, foci of disease remain in the prostate, causing exacerbations of the gonorrhœa and sexual neurasthenia.

In every case of gonorrhœa which lasts an unusually long time and when the second glass of urine is constantly or intermittently turbid, and the pus contains gonococci, the prostate will almost invariably be found to be affected.

By rectal palpation, it will be noted that the prostate is swollen, doughy in consistence, and with scattered spots of softening. On expressing the contents with the finger, a quantity of pus, frequently containing gonococci, is forced out.

This examination is important and should never be omitted, as a large number of cases of latent and chronic gonorrhœa, which after slight excesses show exacerbations, with pus and gonococci in the secretions, are dependent upon chronic prostatitis. (Frank.)

TREATMENT OF THE MILD FORM OF POSTERIOR URETHRITIS.

The irrigation of the urethra and the bladder by means of an irrigator, after Janet's method, is particularly adapted to cases of inflammation of the posterior urethra developing in the course of a gonorrhœa. There are three methods by which the posterior urethra and bladder may be irrigated:—

A. By the Janet method, with an irrigator and hydrostatic pressure.

B. By means of a large syringe with a removable soft rubber tip.

C. By introducing a soft rubber catheter beyond the cut-off muscle, so that its eye lies in the posterior urethra, and injecting solutions through it.

Methods A and B are to be preferred and are in most general use, as the resistance of the cut-off muscle is easily overcome and the anterior and posterior urethra are irrigated thoroughly and the bladder filled.

The solutions to be used are albargin or protargol for the first few days, and as much longer as the process is acute or gonococci are present, and later on, after the process becomes subacute, nitrate of silver solution, from 1 in 10,000 to 1 in 4000, should be employed.

If the prostate is found to be diseased at the same time that posterior urethritis develops, its progress should be closely watched, and as soon as the acute condition has subsided, massage should be begun and continued until such time when no more pus can be expressed, but only a small quantity of secretion of an epithelial character.

Instead of using copious flushings of the urethra, with a considerable quantity of fluid, we can deposit a few drops of a concentrated solution of nitrate of silver directly upon the surface of the mucous membrane by means of Ultzmann's syringe. This syringe is introduced past the cut-off muscle, so that the end lies in the posterior urethra, and 15 or 20 drops of the solution are injected. Nitrate of silver, in strength ranging from 1 to 5 grains to the ounce, is the best application for the purpose.

If we desire to medicate the posterior urethra alone, the patient should retain some urine in the bladder. The urine will neutralize the solution as it flows into the bladder. If a urethro-cystitis be present, the patient should *empty* his bladder first, and the injected fluid will then medicate the posterior urethra and flow back and affect the base of the bladder as well.

As to a selection between the methods of irrigation and instillation, as a general rule, it is found that recent cases with an abundant purulent secretion and which are free from pain or other acute symptoms are most benefited by copious irrigations, and that after the discharge has diminished, so that the urine is clear and only shreds are present, instillations are more serviceable.

Diuretics—such as triticum repens, uva ursi, buchu, etc.—are not indicated in posterior urethritis, since, although they render the urine bland and unirritating, they increase the quantity secreted, and occasion more frequent calls on the bladder to empty itself.

TREATMENT OF THE SEVERE FORM OF POSTERIOR URETHRITIS.

In this form any kind of mechanical interference with the urethra —such as injections, irrigations, or the introduction of any instrument—should be *rigidly avoided.* The patient should go to bed in order to secure rest for the inflamed posterior urethra, lessen its congested condition, and so diminish the vesical tenesmus.

A mild saline cathartic is useful by reducing the congestion of the pelvic organs. Milk should be the staple article of diet, to render the urine bland and unirritating. *Sandal-wood oil* acts almost like a specific in some cases. After a few doses the tenesmus lessens and the escape of blood after urination ceases.

Alkalies or *alkaline mineral* waters are contraindicated, for the reason that the urine in the bladder is necessarily neutral or alkaline in reaction, on account of the abstinence from meat and the milk diet ordered. If the urine becomes alkaline and pyogenic micro-organisms make their way into the bladder from without, a suppurative cystitis is almost sure to occur; so that a moderate degree of acidity of the urine is regarded as the best prophylactic against cystitis.

In order to maintain this condition of acid urine, it has been advised of late to administer *salicylate of soda,* gr. xx three times a day, as this drug has the property of causing a strong acid reaction in the urine.

Morphia is generally required to relieve the excessive tenesmus and allay the frequent desire to urinate. The frequent desire for urination has a bad effect upon the inflammation, since the contractions of the bladder cause an increase in the hyperæmia at its base. Morphia may be given by the mouth, but preferably in suppository.

Hot sitz-baths prolonged for half an hour and used several times a day sometimes lessen the tenesmus and desire to urinate; but, while useful as an adjuvant, they will hardly take the place of opium.

When these methods fail to relieve the tenesmus and pain, which may be intense, the **instillation** of 10 drops of nitrate of silver with an Ultzmann syringe into the posterior urethra often succeeds in calming the disturbance in a few hours. It is desirable to begin with gr. j to the ounce and increase up to gr. v to the ounce, using it every second or third day.

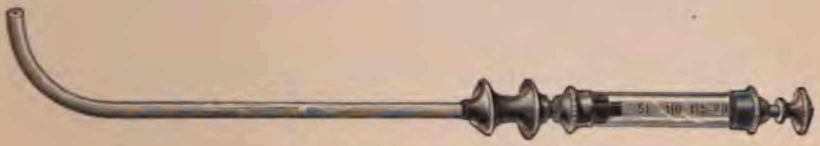

Fig. 22.—Ultzmann's Syringe.

It is always better to use the instillation as a last resort, since we can lay it down as a rule from which there are few departures: "Never to introduce an instrument into a urethra affected with *acute* inflammation."

After acute symptoms have passed off the case assumes the characteristics of the *mild* form of posterior urethritis, and can be treated as such.

RESUME OF THE TREATMENT OF GONORRHŒA.

Abortive Treatment.—*Favorable Cases.*—In commencement, gonococci scanty and extracellular; much epithelium; few leucocytes. Daily irrigations, albargin 1 to 1000.

Methodic Treatment of Ascending Stage.—*Examination.*—Microscopic: Pus abundant; gonococci intracellular. Urine, glass 1 turbid, glass 2 clear.

Treatment.—Sandal-oil internally. Injection of silver salt three times a day, albargin, protargol, or argyrol.

Stage of Decline (third week).—*Examination in Early Period.*—

Microscope: A few pus-cells, few gonococci; many squamous epithelial cells. Urine, glass 1 turbid, glass 2 clear.

Treatment.—Injection of silver salt continued, also begin astringent injection.

Later Period.—*Examination.*—Microscope: Few pus-cells, epithelial cells, no gonococci. Urine, glass 1 clear, shreds present.

Treatment.—Irrigations of urethra, nitrate of silver 1 in 10,000 to 1 in 4000.

(*a*) If relapse with gonococci follows, continue silver salt and astringent.

(*b*) If no relapse follows, irrigating dilatations with the Frank-Kollmann dilator or sound. Irrigations with nitrate of silver, icthargan, or oxycyanat. Hand injections with astringent.

Anterior Urethritis Complicated by Posterior Urethritis.

(*a*) Subacute form.
(*b*) Severe form.

(*a*) *Subacute Form.*—Symptoms almost unnoticeable. Urine, glass 1 turbid, glass 2 turbid. Suspect prostatitis.

Treatment.—Sandal-oil internally. Irrigation, albargin or nitrate of silver, or installations of nitrate of silver.

(*b*) *Severe Form.*—Symptoms, fever, tenesmus, terminal hæmaturia, and pyuria. Urine, glass 1 turbid, glass 2 turbid, possibly blood. Suspect prostatitis and vesiculitis.

Treatment.—Rest in bed, milk diet. Sandal-oil or sodæ salicylat and opium. Hot sitz bath. Hot water irrigation of rectum. No instrumentation or injections.

COMPLICATIONS OF ACUTE GONORRHOEA.

CHAPTER V.

Peracute Urethritis.—In a few cases of gonorrhœa the inflammatory symptoms run very high.

The prepuce and skin of the penis are red, inflamed, and very much swollen. The discharge is profuse, the burning on urination is intense and painful, erections are frequent and difficult to control.

In such cases all local treatment by injections and irrigations is absolutely contraindicated.

The patient should be put to bed, kept on a restricted diet, and lead and opium wash applied to the penis.

The expectant treatment is continued until the severity of the symptoms has abated and the case has assumed the characteristics of an ordinary gonorrhœa, when it may be treated in the usual way.

Severe Burning on Urination is a source of great discomfort to the patient.

It may be moderated often by the administration of sandal-wood oil.

When this fails the patient should drink freely of mucilaginous drinks, such as flaxseed tea or infusion of uva ursi.

Wossidlo recommends that limited quantities of water should be drunk, in order to lessen the volume of urine.

A 2-per-cent. solution of eucaine may also be injected into the urethra before urinating.

Retention of Urine may arise as the result of the congestion occurring about an old stricture and closing its lumen entirely, or it may be due to a spasmodic contraction of the cut-off muscle, or a complicating prostatitis.

Retention is frequently relieved by the administration of a full dose of opium and a prolonged hot bath, but when these measures fail, it is necessary to introduce a catheter, after first washing the urethra most carefully with albargin solution, 1 to 1000, to rid it of pus and prevent infection of the bladder.

Balanitis is an inflammation of the mucous membrane of the prepuce and glans penis, and is apt to occur in men with a long foreskin, and particularly in persons of uncleanly habits.

The *treatment* consists in cleanliness, the use of a dusting-powder, and preventing contact of the opposing surfaces of mucous membrane by means of cotton packed between the foreskin and the glans. Occasionally the œdema and swelling are so great that the foreskin cannot be retracted, giving rise to a condition of phimosis.

Phimosis.—This should be treated by prolonged soaking of the penis in hot water and the use of an antiseptic injection thrown in under the foreskin with a flat-billed Taylor syringe. In the event of gangrene threatening or when the swelling and œdema persist, the operation of circumcision or making an incision through the foreskin upon its dorsum is called for. If chancroids are found under the prepuce after operation, they should be cauterized as well as the freshly made wound.

Paraphimosis is that condition in which a long and tight foreskin is caught back behind the glans and cannot be retracted over the head of the penis.

The *treatment* consists in bringing the foreskin back into its proper place by manipulation. If this prove difficult or if the glans looks gangrenous, the constricting band should be incised on the dorsum, which will generally allow reduction to be effected.

Folliculitis consists in suppuration of one of the urethral follicles, with retention of the pus, forming a small abscess, which, if left to itself, opens spontaneously either into the urethra or through the skin.

The *treatment* consists in laying the abscess-cavity open freely, as soon as fluctuation is noticed, evacuating the pus, and allowing it to heal by granulation.

Cowperitis is a suppurative inflammation of Cowper's glands, and should be treated in the same way as folliculitis.

Inguinal adenitis is an inflammatory enlargement of the lymphatic glands in the groin, which is generally present in gonorrhœa. The glands rarely suppurate, but usually undergo resolution.

The *treatment* consists in rest, hot or cold applications, and pressure. If suppuration occur, it should be treated as a bubo. (See bubo.)

Chordee is a complication which adds greatly to the discomfort of a patient with gonorrhœa. It is due to the plastic infiltration which takes place into the meshes of the corpus spongiosum, and renders it so rigid and inelastic that it cannot become elongated during

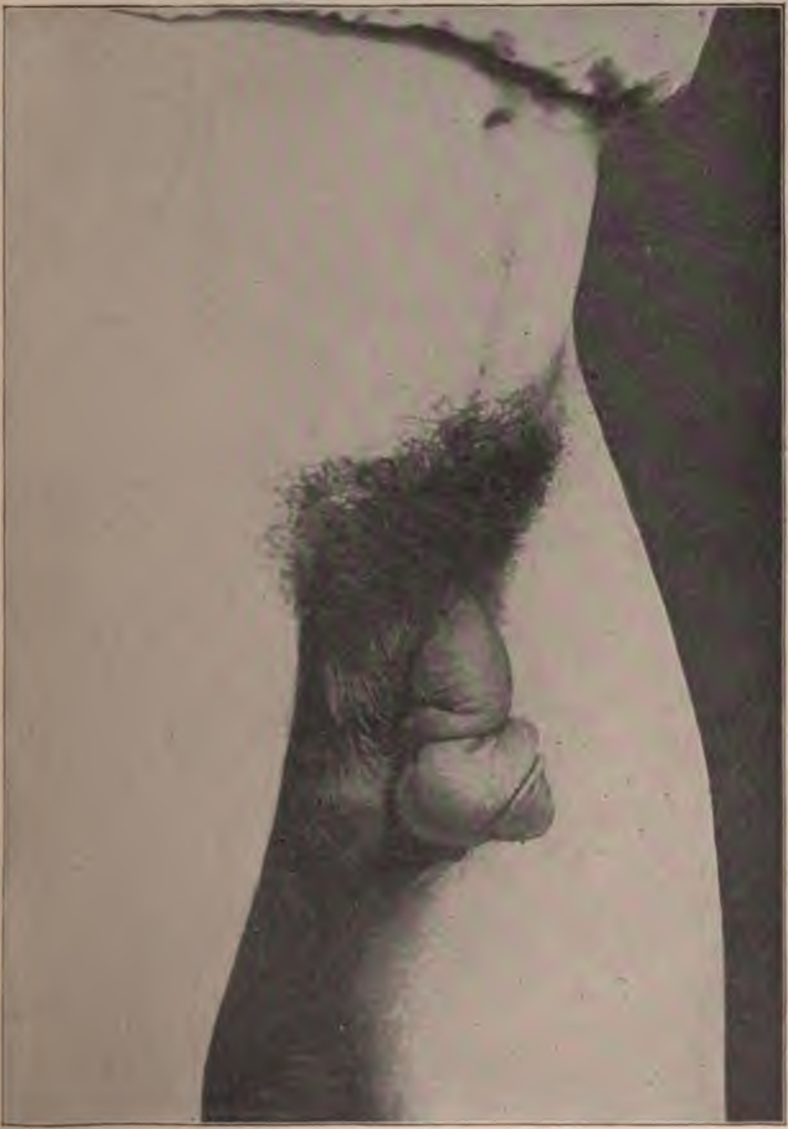

Fig. 23.—Paraphimosis Complicating Gonorrhœa.

erection, but draws on the corpora cavernosa, and bends them down, like the tightened string bends a bow.

Treatment is directed toward preventing these painful erections and allowing the patient to sleep undisturbed. To this end he should use prolonged immersions of the penis in very hot water before going to bed, and should sleep in a cool room, lightly covered. It is better for him to sleep on the side, as the dorsal decubitus favors congestion of the center of erection in the cord.

A towel tied around the waist with a knot in the middle of the back will assist in this, for if the patient lies on his back the knot will press into the flesh and waken him.

In severe cases these measures are not enough, and it is necessary to administer sedative drugs. Lupulin, gr. xxx-xl at bed-time; bromide of potash in large doses, 30 grains in the afternoon and again at bed-time, or monobromide of camphor in 5-grain doses will sometimes answer, and, when they do not, opium must be used, preferably by suppository.

When the patient wakes with the penis erect and painful, he should immerse both penis and testicles in a basin of hot water, or, if that is not at hand, cold water will answer the same purpose, and he should also empty his bladder.

"Breaking the chordee" leads to violent hæmorrhage and ultimately to severe traumatic stricture.

Epididymitis, or inflammation of the head of the testicle, is not a result of metastasis through the blood-vessels or lymph-channels, but is caused by the passage of gonococci from the posterior urethra to the epididymis by way of the seminal vesicles and vas deferens.

The body of the testicle proper is not involved, as a rule, and the inflammation is limited to the epididymis, but the testicle is often *apparently* enlarged on account of its being surrounded by the swollen and inflamed epididymis. Another element which causes the testicle to appear larger than normal is the effusion of serum which takes place into the sac of the tunica vaginalis, and causes hydrocele. This may, in time, be absorbed or remain permanently and increase.

The *symptoms* are always well marked. There is severe pain in the testicle, radiating up into the abdomen. The patient's gait is characteristic: he bends over as he stands, and walks with his legs straddling in order to relax the spermatic cord and relieve it from the weight of the enlarged testicle.

The purulent discharge of the gonorrhœa generally ceases at

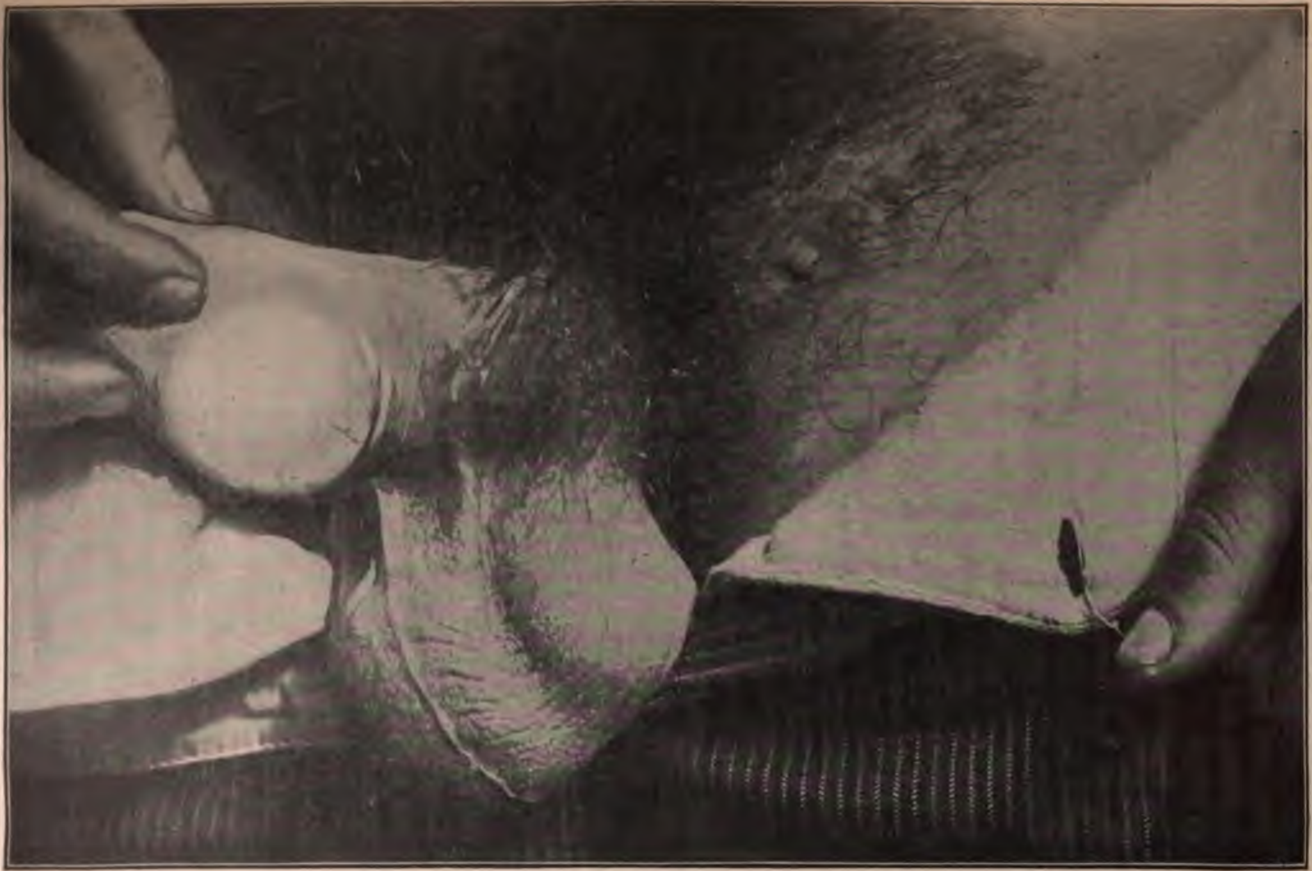

Fig. 24.—Periurethral Abscess, beginning as a Folliculitis. (Author's Case, from the Polhemus Clinic.)

once, and remains absent until the inflammation in the epididymis is better, and then the discharge begins again, only not so profusely as before.

On examining the testicle we find the epididymis enlarged, hard, and tender, and the testicle cannot be readily outlined on account of the effusion of serum into the sac of the tunica vaginalis. The spermatic cord is thickened and very tender. The inflammatory products disappear by resolution and rarely suppurate.

If both epididymes have been affected, a condition of *sterility* may be left, which is permanent. The function of the testicle may be destroyed in three ways:—

I. The most common is the formation of an inflammatory infiltrate in the head of the epididymis, which is not absorbed, but remains and forms a plug, blocking up the efferent duct.

II. An atrophy of the glandular structure of the testicle may occur, probably as a result of inflammatory products in its substance.

III. In very exceptional cases the body of the testicle suppurates and sloughs out, and in this way the organ itself may be entirely destroyed.

Tubercular disease of the testicle occasionally follows a gonorrhœal epididymitis, and is due to the lighting up of a focus of tubercular material, which had been unsuspected and dormant in the epididymis.

Treatment.—If seen within the first few hours, the severity of the inflammation may be lessened by applying three or four leeches along the spermatic cord. The patient should, of course, be put in bed and the testicles supported by means of a Curling handkerchief bandage.

Hot applications are to be preferred rather than the ice-bag, although ice was at one time very popular. While the ice subdues the inflammatory symptoms promptly, its use is very apt to be followed by a hard, tough infiltration in the epididymis, which is never absorbed, but remains, blocking up the epididymis and causing sterility. Another disadvantage of ice is that atrophy of the testicle is more apt to occur in cases where it has been used.

The hot applications can be used in the form of hot lead-and-opium wash or flaxseed poultices.

A favorite treatment in France consists in applying a salve to the inflamed testicle, composed of

℞ Guaiacol.................. .... 20 per cent.
Lanolini,
Resorcin ....equal parts

This should be covered with cotton, with a layer of wax-paper or oil-silk on the outside. A thermophore, hot-water bag, or hot fomentations are then applied outside the dressing.

The guaiacol ointment usually allays the pain promptly and should be changed three times a day. At the time of changing the dressing the patient should take a hot sitz bath for half an hour. The guaiacol ointment should be continued as long as the pain lasts, and after the skin is eroded it should be brushed over with nitrate-of-silver solution, 10 per cent., and dressed with fluidext. hamamelis.

Severe cases may be treated advantageously with peat fomentations and the pain may be relieved by antipyrine or morphine.

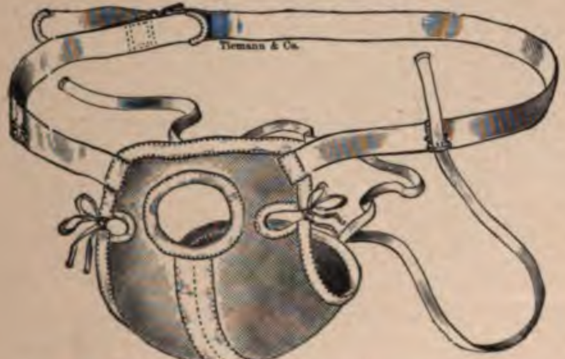

Fig. 25.—Horand-Langlebert Suspensory Bandage.

The bowels should be kept freely open by salts and an enema given every morning. Under this treatment it is said that a hard mass does not remain unabsorbed in the epididymis, causing sterility.

In cases where a great deal of effusion has taken place into the cavity of the tunica vaginalis, it is desirable to relieve the tension promptly by drawing off the fluid with an aspirating needle.

In cases of epididymitis which are not very severe, the Horand-Langlebert suspensory bandage, lined with a thick pad of cotton-batting, fills the indications of rest, warmth, and suspension, and at the same time permits the patient to walk about without pain.

After the patient is out of bed and begins to go about, he should continue the use of the suspensory bandage, and keep the testicle well enveloped in cotton.

It is the custom to use ointments designed to stimulate absorption. The one which is most commonly employed is:—

℞ Ichthyol .... ʒj.
Lanolin,
Vaselin .... aa ʒss.

M. Sig.: To be applied constantly on lint to testicle.

Iodide of potash given internally is of no use in producing absorption of the inflammatory products.

The *Paquelin cautery* is sometimes used by brushing it lightly over the surface of the skin of the scrotum and burning or searing it very superficially. In the beginning of the disease it has the effect of allaying pain, and later on produces absorption of the inflammatory products.

In order to prevent sterility it is important to *promote the absorption of the newly formed tissue in the epididymis.*

In recent cases while the infiltrate is soft this may be accomplished by a sort of massage or kneading of the infiltration between the thumb and finger; but in cases of long standing, when the infiltration has become hard and dense, all such attempts are unsuccessful.

At the time that the zinc salts were used as injections in gonorrhœa it was the practice to stop local treatment as soon as epididymitis developed, and not begin again until it was entirely cured.

Since the introduction of the silver salts, however, this rule no longer absolutely applies, and in cases where the inflammation is not too severe, the urethral injections of albargin or protargol may be continued without cessation, even though the testicle is swollen. (Frank.)

In order to prevent the development of an epididymitis in cases of chronic gonorrhœa or enlarged prostate, after instrumentation of the urethra or massage of the prostate, Frank advises a thorough irrigation of the urethra before and after instrumentation, in order to rid the canal of organisms which may otherwise make their way through the ejaculatory ducts and vas deferens to the epididymis.

By following this plan he finds a marked diminution in the number of cases which develop in the course of treatment.

Gonorrhœal rheumatism is an inflammation of one or more joints occurring in the course of a gonorrhœa and due to the direct action of the gonococcus. The gonococci are carried through the blood-current, and are deposited in various joints, where they set up an inflammation in the synovial membrane lining them.

If the gonococci alone are deposited in the joint, the resulting inflammation causes an excessive secretion of serum, and a simple *hydrarthrosis* results, or the inflammation may attack the synovial sheaths of tendons and the bursæ, occasioning a chronic thickening, with ankylosis of the joints from the formation of connective tissue. These cannot be successfully operated upon afterwards, and the joint remains permanently stiffened.

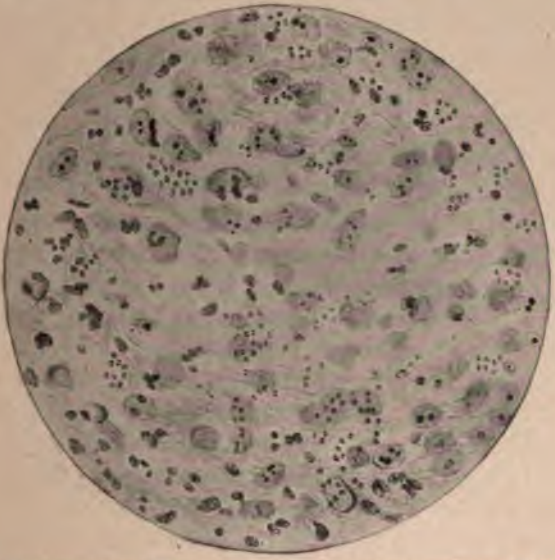

Fig. 26.—Gonorrhœal Rheumatism. Synovial membrane infiltrated with numerous intracellular gonococci.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

Suppurative inflammations of the joint are due to a mixed infection; in addition to the gonococci, staphylococci and streptococci are the exciting causes.

Clinically we can distinguish three forms of gonorrhœal rheumatism:—

(*a*) *Hydrarthrosis*, which is usually confined to a single joint (monarticular), and is generally the knee.

(*b*) Resembling ordinary rheumatism, since it begins with fever, and several joints are involved.

(*c*) The synovial sheaths of tendons and muscles and the bursæ are attacked and become the seat of chronic inflammatory changes. The joints may be involved or may escape.

The course of all forms is very slow, and recovery is always protracted.

Pericarditis and endocarditis also frequently occur, with ulcerations of the valves and the formation of deposits upon them, which contain gonococci.

Treatment.—It is of essential importance to treat the gonorrhœa, which almost always affects the posterior urethra or its adnexa.

In the cases which begin with active symptoms—high fever, rapid pulse, and the affection of several joints—salicylate of soda acts well, but in a case which is insidious in its beginning and turns out to be a slow, chronic synovitis, giving rise to hydrarthrosis, the salicylates are of little use.

Iodide of potash given in increasingly large doses, even as high as 3 or 4 drachms a day, is sometimes of more benefit than anything else. Salol and oil of gaultheria are also sometimes of use.

The *local treatment* is important. The inflamed joint should be put at rest by keeping the patient in bed and applying a light splint to immobilize it. If much heat, redness, and swelling are present, an evaporating lotion or an ice-bag is in order.

New methods of treatment which are reported to be very valuable are the use of dry hot air or "baking" and the Bier steaming apparatus, the latter of which may be used for half an hour two or three times a day. It is said that under the combined effects of the hot air and the Bier apparatus the bacteria die, and in one or two days the pain is relieved. After the acute stage has passed off the indications for treatment are:

I. *To produce absorption of the watery effusion in the joint.*

The most powerful agent, to this end, is *blistering,* and it should be applied on different parts of the skin over the joint, and used often enough to keep the surface raw for a considerable length of time.

Ichthyol ointment, of 50-per-cent. strength, is sometimes useful as an absorbent. In all chronic cases when the patient walks about *pressure* over the joint by means of a rubber bandage should be applied, and this may serve as a substitute for blistering when the amount of fluid is slight.

It was formerly recommended, when in spite of treatment the fluid did not disappear, to aspirate the joint, draw off the fluid, and irrigate with a solution of bichloride of mercury. This plan of treatment can only be condemned, as the risk of causing a permanently ankylosed knee-joint is too great to warrant the procedure.

After the effusion in the joint has been absorbed, or in those cases where the disease has attacked the synovial sheaths and fibrous structures about the joints, the indication is:—

II. *To cause absorption of the inflammatory deposit, which has taken around the bursæ, tendons, and synovial sheaths.*

This can be best accomplished by massage, which should be begun as soon as the patient can tolerate it, and the massage may be assisted by douching or spraying with hot and cold water alternately.

In the treatment of gonorrhœal rheumatism, it is important to begin active treatment early, for if not treated energetically at first it becomes chronic and is very difficult to cure.

It is also of essential importance to treat the gonorrhœa, which has become chronic and frequently has involved the prostate and vesicles.

CHAPTER VI.

CHRONIC URETHRITIS.

CHRONIC urethritis is one of the most obstinate and difficult affections to cure, which the genito-urinary specialist is called upon to treat, unless the treatment is based upon a knowledge of the pathological changes which have taken place in the tissues, and the character and exact location in the urethra of the lesions.

A case of gonorrhœa may be called chronic when it has lasted for ten or twelve weekks.

Chronic urethritis is sometimes incorrectly called "*gleet*," but the true definition of gleet is: *A chronic muco-purulent discharge produced in certain localized areas of the mucous membrane of the urethra which are in a state of chronic catarrhal or granular inflammation.*

The statement that every case of gleet is dependent upon a stricture is an incorrect one. A gleety discharge may be occasioned by superficial changes in the mucous membrane, which never produce any narrowing of the urethra. On the other hand, in cases where stricture does exist, the mucous membrane lying above is never healthy, and a gleety discharge is always present.

The **predisposing causes** of chronic urethritis may be summed up as follows: Anything which tends to prolong or prevent the natural healing of a gonorrhœa, such as: (*a*) Careless ways of living on the part of the patient. (*b*) Injections which are too strong or used too frequently. (*c*) Use of alcohol or beer. (*d*) Sexual intercourse or erotic excitement.

At other times, cases which are properly treated and which have had good care, become chronic, usually on account of some diathetic taint, either tuberculosis, rheumatism, gout, or sometimes incipient pulmonary phthisis.

It is convenient to study chronic inflammation of the ***anterior*** urethra by itself, although the posterior urethra is apt to be affected as well, at the same time.

CHRONIC ANTERIOR URETHRITIS.

PATHOLOGY.

As a result of gonorrhœa, particularly in its later stages, an *infiltration of small round cells* takes place. This infiltration is the most important characteristic of the disease, and most of the other changes in the tissues result from it. The small round cells originate partly from the capillary vessels of the mucosa and partly from a proliferation of the fixed connective-tissue cells.

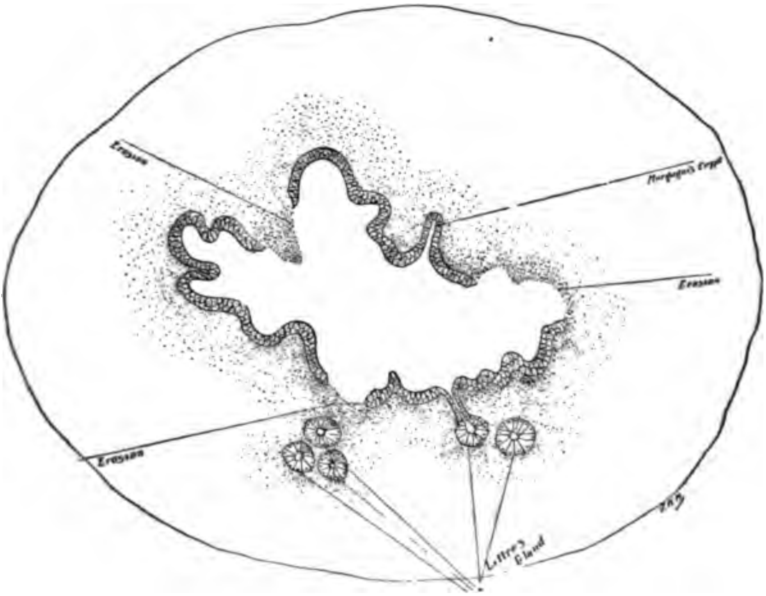

Fig. 27.—Diagram of a cross-section of the urethra, representing the histological changes in chronic urethritis.

The small round-celled infiltration begins in the submucous connective tissue and surrounds the lumen of the urethra completely.

Its favorite points of location are most frequently around the bulbous urethra, and next in frequency at the fossa navicularis. These are the widest and most dilatable portions of the canal, and in acute gonorrhœa the stream of urine is not sufficient to wash out the pus, which stagnates here and acts as a focus for the renewed local infection of the tissues at these points.

The mucous glands and follicles (Littré's glands and Morgagni's crypts), which dip down into the meshes of the corpus spongiosum, are also surrounded by and imbedded in the infiltration.

Clinically we may classify the cases of chronic urethritis according to the extent of the infiltration into: (*a*) *superficial,* or *mucous,* form, in which the small round-celled infiltration is confined to the mucous membrane, subepithelial connective tissue, and periglandular tissue alone, and which is not followed by stricture, and (*b*) the *deep form* of infiltration.

In the latter class the infiltration extends *deeply* into the tissues, and involves the meshes of the corpus spongiosum extensively and is always followed by stricture.

Glandular Changes.—During the course of the gonorrhœa the gonococci penetrate into *Morgagni's crypts and Littré's glands* and set up an inflammation in the cavities, which is accompanied by an infiltration of small round cells *around* the ducts and walls of the glands (periglandular infiltration).

The infiltration around the duct stiffens it and keeps its mouth open and gaping, affording an open gateway for the escape of the inflammatory products which have formed within the cavity of the gland.

The gonococci may continue to propagate within the cavities of the glands for months after the inflammation has entirely ceased on the free surface of the mucous membrane.

The reappearance of an acute purulent discharge containing gonococci, a so-called *relapse,* is due to an escape of gonococci from the glands and a reinfection of the surface of the mucous membrane.

Infection of wives and mistresses with gonorrhœa, during coitus, is often caused in the same way, viz.: the escape of pus-cells containing gonococci, which had been formed by the suppurative process continuing in the gland-cavities after the surface of the mucous membrane had been well for months. During intercourse the pus, mixed with seminal fluid, is deposited in the vagina of the female and infection follows.

The inflammatory products, consisting of desquamated epithelial cells, pus-cells, and granular material, which stuff the cavities of the glands, are washed out by the act of urination and appear floating about in the urine as shreds.

The small granules are probably formed in the glands of the anterior urethra, and the larger plugs, shaped like a comma or tadpole (Fürbringer's hooks), originate in the follicles of the prostatic urethra.

Larger "clap-shreds" are also always present, and are occasioned by the secretion from erosions drying upon the surface, forming a scab, which is washed away by the stream of urine.

Changes in the Mucosa.—During the acute inflammatory stage of a gonorrhœa the cylindrical epithelium lining the urethra is loosened and thrown off in patches, leaving superficial *erosions*. These losses of epithelium, except in very rare instances, are not deep enough to deserve the name of ulcers.

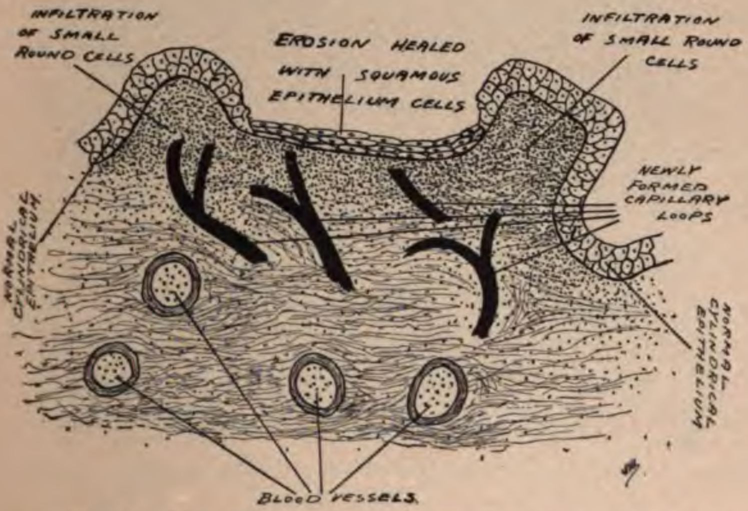
INFILTRATION OF SMALL ROUND CELLS
EROSION HEALED WITH SQUAMOUS EPITHELIUM CELLS
INFILTRATION OF SMALL ROUND CELLS
NEWLY FORMED CAPILLARY LOOPS
NORMAL CYLINDRICAL EPITHELIUM
NORMAL CYLINDRICAL EPITHELIUM
BLOOD VESSELS

Fig. 28.—Diagram of a section of the urethra, representing the histological changes in the formation of a granular patch in chronic urethritis.

On account of the round-celled infiltration of the submucous tissues the erosions do not heal readily, but remain uncovered by epithelium for a long time.

The blood-vessels in the submucous tissues send up newly-formed capillary loops, which traverse the infiltration in an upward direction, and as they grow toward the surface penetrate the floor of the erosion and convert it into a bed of newly-formed *granulations*.

These "granular patches" resemble an ulcer in any part of the body after it has become covered with luxuriant florid granulations, which are composed purely of capillary loops, having no tendency to cicatrize and which are easily broken down and destroyed by slight force.

In other cases the mucous membrane is not eroded and there are no granular patches present: Instead of a loss of substance there is simply swelling, congestion, and œdema of the mucous membrane, in scattered patches, occasioned by its being in a condition of chronic inflammation and infiltration with leucocytes.

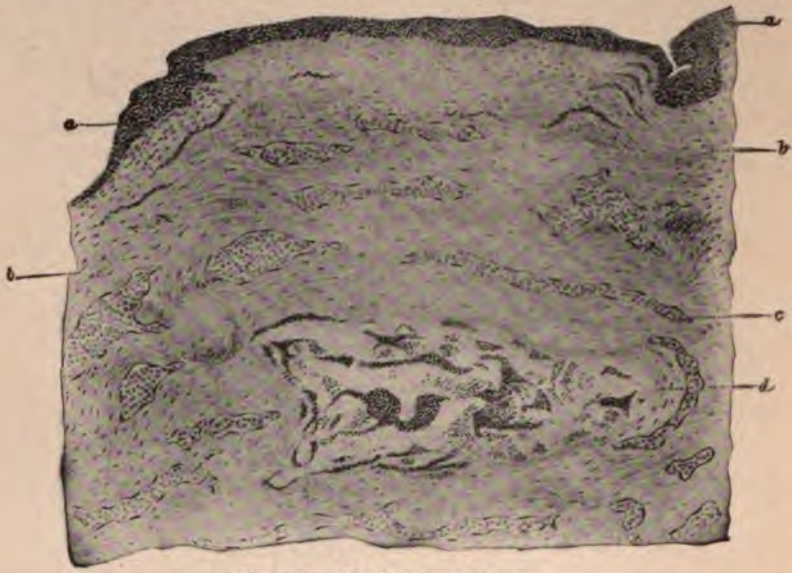

Fig. 29.—Beginning Stricture.

a, Squamous epithelium in many layers.
b, Contracted connective tissue.
c, Contracted meshes of the corpus spongiosum.
d, Remains of Littré's gland, obliterated through contraction of the periglandular and interstitial connective tissue.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

These superficial changes in the mucous membrane occasion a continuous gleety discharge until they are healed.

Final healing of the lesions is brought about as follows:—

When the small round-celled infiltration is first deposited, it is soft and succulent, and while in this state it may disappear, entirely or in part, by a process of *absorption.*

If absorption does not take place, the small, round, infiltrating cells become organized, and are replaced by true fibrous connective tissues of a low grade, which goes on to *contraction.*

In a case where the infiltration was of the *superficial*, or *mucous, form,* involving only the mucous membrane and surrounding the glands, stricture does not follow.

In the *deep* form of infiltration, however, which extends deeply into the periurethral tissues and involves the meshes of the corpus spongiosum extensively, the heavy masses of scar-tissue, into which the infiltration becomes converted, contract, impair the dilatability or may materially decrease the calibre of the urethral canal, and form *stricture.*

After the infiltration which surrounded Morgagni's crypts and Littré's glands has been converted into scar-tissue, its subsequent contraction squeezes the walls together; so that the glands are compressed and obliterated.

The granulations, which have formed upon the erosions, consist simply of capillary blood-vessels, which have been given off from the submucous vessels and have penetrated the infiltration in an upward direction. After the formation of scar-tissue its contraction squeezes the capillaries together and destroys them, and the granulations disappear as a result of strangulation.

The erosions become covered, not with the normal cylindrical epithelium of the healthy portions of the mucous membrane, but by many layers of squamous epithelium.

The changes wrought by the conversion and contraction of the scar-tissue require from two to ten years for their completion, and they do not proceed with a uniform degree of rapidity; so that, on examining a case, all gradations of the process may often be seen at the same time.

SYMPTOMS.

There is an absence of any marked subjective symptoms; there may be at most an occasional tickling at the meatus.

The *discharge* from the urethra is muco-purulent, thin, and scanty, and is often so slight that there is only a drop in the morning or a sticking together of the lips of the meatus.

A common feature of chronic urethritis is the *exacerbations* which are constantly occurring. The patient develops a profuse purulent discharge, which is checked very promptly by treatment.

As a result of various indiscretions, an acute inflammation is set up in the damaged portions of the urethra, and the discharge which is produced in them occasions a *reinfection* of healthy portions of the canal, as it passes over them.

When a considerable extent of surface of the mucous membrane is involved in the inflammatory process, if the patient passes his water into two glasses, the first glass is *turbid* from the quantity of pus washed out from the canal. On microscopic examination the discharge is found to be composed of pus-cells, containing gonococci in profusion, desquamated epithelial cells, and mucus from crypts and follicles. After the inflammation is *localized,* and exists only in spots, the urine in the first glass is no longer turbid, but shows a few shreds floating in *clear* urine.

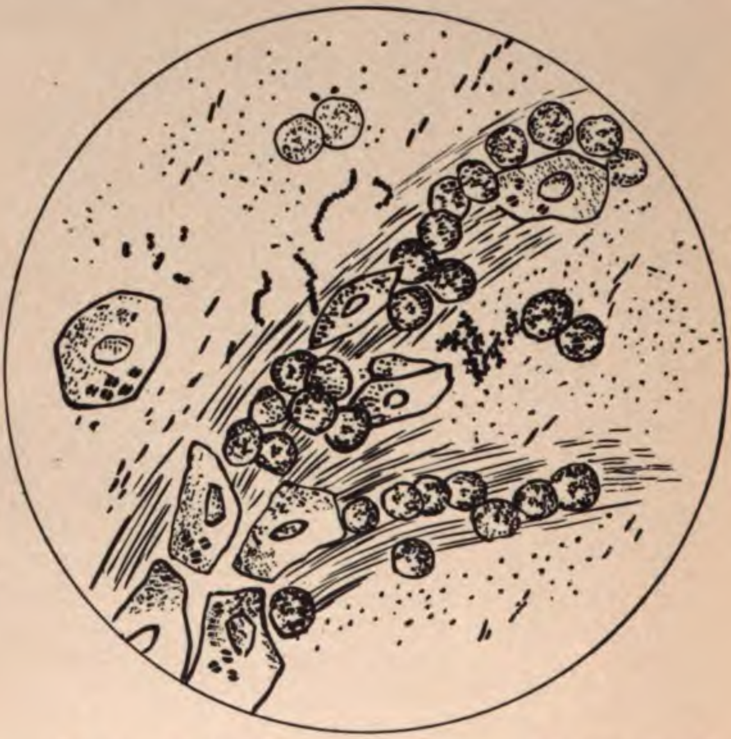

Fig. 30.—Shred from a case of Gonorrhœa of long standing. Mixed Infection has occurred. The specimen shows desquamated Squamous Epithelial cells, with Gonococci on their surfaces, Pus-cells, Staphylococci, and Streptococci arranged in chains.

The presence of *shreds* always indicates that at some point along the urethra the mucous membrane is diseased, and a shred is simply the secretion, which forms a scab on the surface, and is washed off by the stream of urine. The form of lesion may be an erosion or granular patch or a chronic catarrh of the mucous membrane lying over an infiltration.

Microscopic examination shows the *composition* of shreds to be pus-cells, which may or may not contain gonococci, and desquamated epithelium, held together by a quantity of mucus.

In *shape* shreds present themselves as heavy flakes; long, slender filaments; tadpole-shaped bodies, or small granules. The heavy shreds always contain pus, and sink to the bottom, while the light filaments are composed entirely of squamous epithelial cells and float. The point of practical clinical importance to determine is whether the shreds are made up of pus-cells containing gonococci, or whether they are composed of squamous epithelium alone, desquamated from the healed surface of a former lesion.

DIAGNOSIS.

The points to determine in making the diagnosis of the conditions in chronic anterior urethritis are:—

(*a*) Whether a considerable surface of the urethral mucous membrane is involved in the inflammatory process, and secreting pus freely. When this is the case it is indicated by a *turbid*, cloudy appearance of the first glass of urine, on making the two-glass test. Or

(*b*) Whether the inflammation is no longer general, but limited to *localized areas*. In the latter condition the first glass of urine will contain *shreds* floating in *clear* urine.

It is equally important to ascertain if:—

(*c*) The inflammatory process is *superficial;* that is, limited to the mucous membrane and glands; or if:—

(*d*) The infiltration has involved the meshes of the corpus spongiosum, and commencing stricture is present. The instruments useful in settling points *c* and *d* are: (1) the Otis urethrometer, (2) the bulbous bougie, and (3) the endoscope.

Otis Urethrometer.—*Method of Using.*—The point of *greatest dilatability* of the normal urethra is at the bulb, and on withdrawing the urethrometer we find that the dilatability of the urethra is diminished *gradually* toward the meatus, except at the fossa navicularis.

When a *deep* infiltration is present the dilatability of the urethra is diminished *abruptly*, but the urethral canal is freely dilatable both *before* and *behind* the infiltrated point.

On the other hand, *superficial* infiltrations involving only the

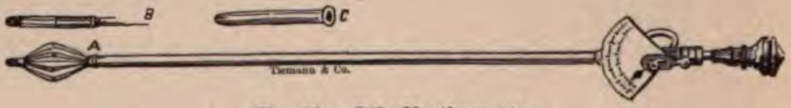

Fig. 31.—Otis Urethrometer.

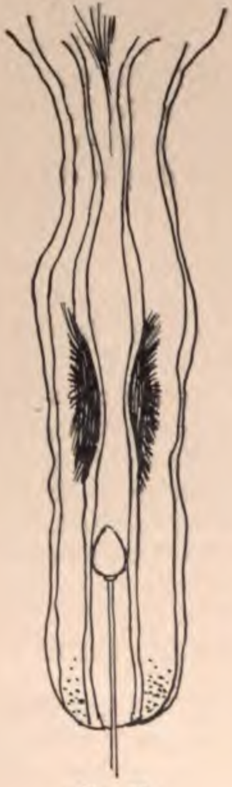

Fig. 32.

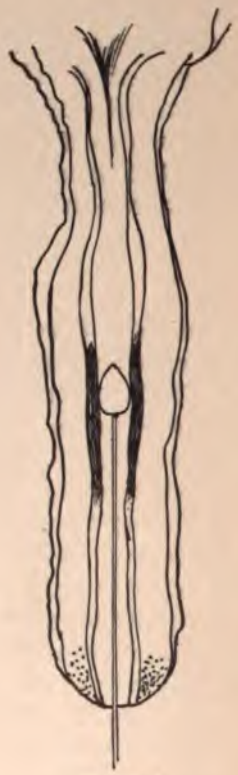

Fig. 33.

Fig. 32.—Diagram showing method of detecting deep infiltration, in chronic urethritis, with Bougie à Boule or Urethrometer.

Fig. 33.—Diagram showing impossibility of recognizing superficial infiltration, involving mucous membrane alone, by means of Bougie à Boule or Urethrometer.

mucous membrane do not extend into the deeper submucous tissues or meshes of corpus spongiosum and do not interfere with the dilatability of the urethral canal.

It is important to recognize deep infiltrations, while they are still soft and recent and before they have been converted with scar-tissue, so as to bring about their *absorption* and prevent the formation of stricture.

The bulbous bougie, preferably the flexible variety, may be used for the same purpose, but is better adapted to recognizing infiltrations which have been transformed into scar-tissue and begun to contract.

TREATMENT OF CHRONIC ANTERIOR URETHRITIS.

To understand clearly the indications for treatment it may be desirable to recapitulate the forms which chronic urethritis assumes, using Finger's classification.

Forms of Chronic Urethritis.

I. *Recent cases,* in which an extensive surface is involved in a general catarrh.

II. *Cases of long standing which are more chronic,* in which, instead of a general inflammation, the process is localized in isolated spots. The disease may be

(*a*) *Superficial* and confined to the mucous membrane, or

(*b*) *Deep* and in the submucous connective tissue, often complicated by

(*c*) Affections of the paraurethral glands.

In the cases of chronic urethritis of the **superficial variety**—that is, when the diseased condition is limited to the mucous membrane, and does not affect the deeper tissues—*the indications for treatment* are (*a*) to rid the tissues of gonococci; (*b*) to cure the catarrhal inflammation so that only the deep foci remain; (*c*) to promote the formation of squamous epithelium to cover the erosions.

These indications are fulfilled by the local application of astringent and antiseptic solutions. When **general catarrh** of the mucous membrane is present, as indicated by turbidity of the first glass of urine, the patient may inject his urethra with an ordinary gonorrhœa syringe, and gradually increase the strength of the injections. (For formulæ see "Acute Gonorrhœa.") It is preferable, however, to use an *irrigator,* which has the advantage of distending the folds of mucous membrane and insuring a thorough contact of the solution with its entire surface.

A soft-rubber catheter, attached to a large-sized hard-rubber syringe holding 4 ounces, carried down into the bulbous urethra, may be used, but it is not as effective as the irrigator. (See Janet Irrigation.)

As long as microscopic examination shows the presence of gonococci, the best solution to use for irrigation is albargin, 1 in 1000. Under irrigations every day or every second day the pus disappears and the urine becomes clear, with a few shreds floating in it, and the gonococci are no longer to be found with the microscope.

Nitrate-of-silver irrigations, 1 in 10,000 to 1 in 4000, may be substituted for the albargin at this point. The appearance of a marked reaction with free suppuration and gonococci after the nitrate of silver denotes that a focus of gonococci had been opened up and a reinfection of the tissues caused.

If no reaction follows, the nitrate-of-silver irrigations may be continued, until no further improvement is noticed and the case is at a standstill.

The process at this time has ceased to be general and is confined to isolated spots, and on examining the urine it is found no longer to be turbid from admixture with pus, but *clear and with numerous shreds* floating in it. The presence of clear urine containing shreds is regarded as an indication for substituting stronger applications to the diseased spots than can be used by irrigation.

The best means of applying strong astringents to the isolated foci are by means of (*a*) the Ultzmann's brush apparatus, and (*b*) instillations with an Ultzmann or Guyon syringe.

The Ultzmann's Brush Apparatus.—This instrument is particularly adapted to the treatment of old foci of inflammation which are located in the bulbous dilatation of the urethra, accompanied perhaps by a few scattered areas along the anterior urethra.

If the instrument is introduced and the entire anterior urethra is brushed over, by a combined rotary and withdrawing motion of the brush, with a solution of nitrate of silver from 15 to 25 grains to the ounce in strength, and examined immediately afterward with the endoscope, the diseased spots will be seen to be colored a whitish gray, while the healthy portions of mucous membrane will appear unaltered by the nitrate of silver. In this way the growth of epithelium is stimulated over the eroded spots.

Particular attention should be given to the bulb, brushing it out first with water to remove the adherent secretion, subsequently *twice* with the medicament. Instead of nitrate of silver, Frank advises using a solution of lactate of copper, 2 per cent., in glycerine, applied every second day.

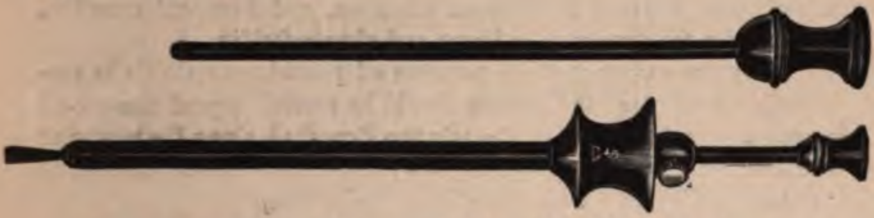

Fig. 34.—Ultzmann's Brush Apparatus. (Kny-Scherer Company.)

Instillations.—By means of Guyon's or Ultzmann's syringe concentrated solutions of nitrate of silver can be deposited, drop by drop, along the whole length of the urethra, from the vesical sphincter to the meatus, thus bringing the medicament in contact with healthy and diseased portions alike.

The patient may be allowed to use a mild astringent injection, upon the days when no instillation is made.

During the course of the treatment *exacerbations,* accompanied by vesical tenesmus, free suppuration, and turbidity of both glasses of urine, occur at times. When these happen, the instillations must, of course, be suspended and either sandal-wood oil or salicylate of soda given by the mouth, or, if the exacerbation is not very severe, the case may be treated by irrigations until the urine is again free from pus, when the instillations may be resumed.

It is very exceptional for the diseased foci to be so isolated that they can be treated in any other way, even through the endoscope.

The indication for the use of instillations of nitrate of silver is considered to be the *presence of clap shreds floating in clear urine.*

In a case coming under treatment, however, for the first time, instillations should never be used until the effect of irrigations has been tried, for the treatment of chronic gonorrhœa is founded upon the principle of beginning with mild applications and gradually proceeding to the use of stronger and more irritating measures.

Another point to bear in mind is the fact that the irritation

caused by the application of concentrated and caustic solutions may in itself prolong the inflammation and prevent the recovery. So that it is always desirable, in a case which has been energetically treated, to interrupt, for two or three weeks, all local applications, in order to allow the irritation caused by them to subside.

In beginning the treatment with instillations, 15 drops of a 2-grain-to-the-ounce solution of nitrate of silver should be used, which causes some reaction, burning on urination, and increased secretion, which lasts for twenty-four hours and then subsides.

In every case where the presence of posterior urethritis is suspected, the point of the syringe should be carried beyond the cut-off muscle and a few drops of the solution deposited along the posterior urethra; and as the syringe is withdrawn the anterior urethra is "etched," a drop at a time, along its entire length.

The instillations should be made every two days and used two, three, or four times, or, in fact, as long as a diminution in the shreds is noted. By this time the urethra has become accustomed to the irritation of the solution, and its strength must be increased to 5 grains to the ounce. The strength of the solutions is gradually increased in this way until the patient is well or until a strength of 25 grains to the ounce is attained.

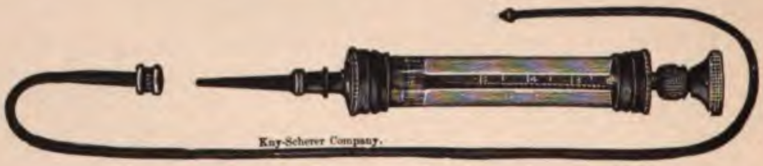

Fig. 35.—Guyon's Syringe.

Various other means have been suggested for applying astringents to diseased spots in the mucous membrane, such as gelatine or cocoa butter suppositories, medicated ointments, and direct applications through the urethroscope.

None of these methods has proven satisfactory, and while applications through the urethroscope to the posterior urethra are indispensable in certain cases of swelling of the colliculus, the only use for the urethroscope in the anterior urethra is as an instrument for diagnosis or to permit the removal of polypi or the destruction of chronically inflamed Morgagni's crypts.

The use of *astringent injections* may be continued by the patient

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himself during this time as an adjuvant to irrigations and stronger applications.

Care should always be taken, however, not to use the injections often enough to add to the irritation resulting from the other applications.

In treating patients with chronic urethritis it should always be borne in mind that in nearly every case a submucous infiltration of small round cells is present in the deeper tissues, often complicated by disease of the paraurethral glands, and it is impossible to cure the lesions on the surface as long as the deep or submucous infiltrate exists.

The deep form of chronic urethritis must be treated on entirely different lines from the superficial variety.

In these cases the infiltration lying underneath the mucous membrane cannot be reached by applying astringent or bactericidal solutions to its surface, and; while the secretion may be held temporarily in check, an exacerbation occurs on the slightest provocation.

The indications for treatment are:—

I. To promote the absorption of the infiltration and restore the elasticity of the urethral wall.

II. To subdue the existing superficial inflammation in the mucous membrane and glands.

III. To destroy the gonococci, which are harbored in the substance of the infiltration and in the urethral glands.

The first indication—that is, the promotion of the absorption of the infiltration—is met by the passage of a **steel sound** large enough to distend the urethra fully and put the ring of infiltration upon the stretch.

The therapeutic effects of the passage of sounds are:—

I. To allay urethral hyperæsthesia. The passage of the sound blunts the extreme sensitiveness of the nerve-filaments and abolishes any spasmodic contractions of the muscular fibres which may be present.

II. The infiltration lying beneath the mucous membrane renders it rigid and impairs its elasticity. A sound large enough to distend the urethra stretches the infiltration and causes small tears in its substance beneath the mucous membrane. A traumatic inflammation, with increased vascularization, results from these tears, and absorption is stimulated.

III. The passage of a sound expresses and squeezes out the contents of the suppurating urethral crypts and follicles.

IV. The stretching of the urethral walls by the sound breaks down granulations and stimulates the formation of epithelium upon eroded spots.

In order to meet these conditions it is necessary to use a sound of *large* calibre, which will fully distend and stretch the urethral canal.

The sound should not be passed too frequently. In cases of soft and recent infiltration the intervals may be from two to four days, always waiting until the reaction following has subsided. In cases of hard, organized infiltration the intervals should be longer: from five to eight days.

If the *meatus* is too narrow to admit a sound of sufficient size, it should be divided upon the floor.

There are, however, certain cases where it is undesirable to enlarge the meatus, as, for instance, in hypospadias, and, again, there are other cases where the urethra is so capacious that a No. 30 French sound will lie in it loosely without stretching the walls or compressing the infiltration. In these cases recourse may be had to the **Oberlaender or Kollmann dilator,** and by preference the new model of irrigating dilator by which irrigation of the urethra is carried on simultaneously with the dilatation.

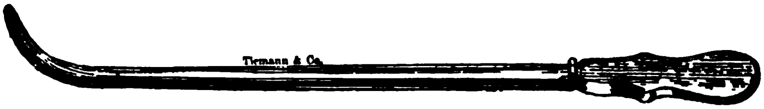

Fig. 36.—Steel Sound with Van Buren Curve.

The action of a dilator is to tear apart the infiltration underneath the mucous membrane, which remains intact without being wounded.

This is an important feature of dilatation, since any fresh wound of the mucous membrane would open up a passage for revived infection with micro-organisms.

Oberlaender claims that a fresh inflammation starts up from the tears in the infiltration, and the increased vascularization occurs in its absorption.

The dilatation also causes an exfoliation of epithelium in other parts of the urethra.

The effect of dilatation is also very marked on the mouths of Morgagni's crypts. The mouths of the crypts may be kept open and gaping by a stiffened ring of periglandular infiltration.

Free dilatation puts them on the stretch, forces out their stagnating contents, and causes the absorption of the infiltration. If, on the other hand, the mouths of the crypts are closed by a hyperplasia of epithelium over them, dilatation opens them and permits the escaping of the retained secretion.

The Frank or Kollmann dilators with the irrigating attachment are to be preferred to Kollmann's simple dilator, as these instruments are provided with three and four blades, and the pressure is brought on fewer sides of the urethral wall.

It is also of great advantage to irrigate the urethra when it is fully dilated, for at this time the mouths of Morgagni's crypts are open and the irrigating fluid enters them, besides coming in thorough contact with the walls of the urethra, when its folds are smoothed out.

It should always be borne in mind in using these dilators that the dilatation must be made very gently, for with the powerful leverage of the instrument extensive lacerations may easily occur unless great care is used.

A laceration is a serious accident. The hæmorrhage may be alarming in its extent and urinary fever is very apt to follow.

If inflammation and secretion are present in chronic gonorrhœa, dilatation may be begun at 26 or 28 at the first sitting, and increased at the other sittings.

In a week another dilatation may be made and the dilatations in the course of some weeks carried up to 35 or 36, increasing one or two numbers at each sitting. After 36 is reached the dilatation must be done more cautiously, ascending from one-half to one number at a sitting.

Improvement is generally noted about 35, when the shreds begin to grow lighter.

The dilatation may be carried up to 45, but it is seldom necessary.

When the infiltration is confined to the anterior urethra alone, the anterior dilator is of course required; but when the disease has affected the membranous and prostatic portions of the urethra the posterior dilator must be used.

The dilator may be used even though a few gonococci are present, but it is always better to rid the urethra of gonococci as much as possible by an active course of treatment before commencing the treatment with the dilator.

If the urethra is acutely inflamed and secreting pus freely, instrumentation is, of course, out of the question, and the dilatations should not be begun until the urine is clear and contains only shreds.

With regard to the appropriate solutions for irrigating the urethra, albargin, 1 to 1000, should be used as long as gonococci are present. After they have disappeared, nitrate of silver, 1 in 10,000 to 1 in 4000, is in order. Oxycyanat of mercury, 1 to 4000, is the best solution when no gonococci, but other micro-organisms are present in numbers.

In the intervals between the dilatating irrigations the patient should have urethral irrigations made every other day by the surgeon (see Janet irrigation), and should use a hand injection of one of the astringent salts himself.

It makes no difference, as far as treatment is concerned, whether the submucoid round-celled infiltration is soft and recent or whether it has been transformed into scar-tissue. The indications in either case are, by dilatation and pressure to promote its absorption. Cases in which a considerable surface of mucous membrane is involved are unsuitable for dilatation, until the catarrh has been checked by irrigations and the superficial process is localized in a few spots in the urethra, as denoted by shreds floating in clear urine.

The second and third indications—which are to cure the inflammation in the mucous membrane and glands and destroy the gonococci—have already been considered under the treatment of the superficial form of urethritis, and the measures adapted to these ends should be combined with the dilatation.

If a simple dilator without the irrigating attachment or a sound is used, it is always necessary to use a copious irrigation of the urethra afterwards.

The folds of the mucous membrane are smoothed out by the pressure of the sound and the solution comes in contact with the whole surface. If small tears have occurred in the mucous membrane from stretching, the irrigating fluid seals them up and prevents infection.

Affections of the paraurethral glands, especially **Morgagni's Crypts**, are often responsible for the cases of latent chronic gonorrhœa, characterized by exacerbations on slight provocation. When the mouths of the glands are occluded by the growth of epithelial cells over them, dilatation of the urethra opens up their mouths and forces out the purulent secretion contained within them.

The accompanying irrigation enters their cavities and acts upon the chronic inflammatory process within the glands.

In the second form of affection of the glands, where their mouths are held open and the entire crypt is stiffened and inelastic from the periglandular infiltration, dilatations cause the absorption of the infiltrate around the glands and a return to the normal conditions.

When after sufficient treatment with dilatation and irrigations, it is found by urethroscopic examinations that a few glands still remain chronically inflamed and suppurating, acting as foci of infection, they should be treated as any other suppurating sinus and freely incised on the floor. This can be accomplished by bringing them into view with the urethroscope, introducing a galvano-caustic needle into them, and burning the tissues through on the floor.

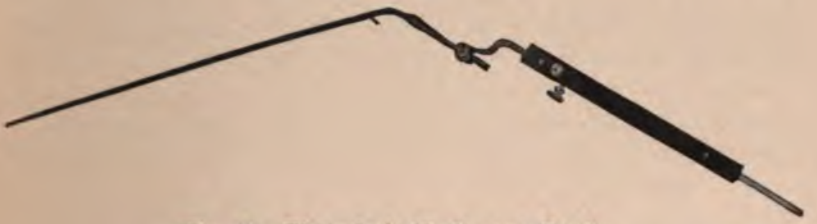

Fig. 37.—Electrolysis Needle and Handle.

Two or three glands may be so disposed of at one sitting, and often cases which have resisted the usual treatment can be cured in this way.

In all cases of chronic urethritis the condition of the prostatic and seminal vesicles should always receive attention, for in the large proportion of individuals so affected, the *prostatic* and *seminal vesicles* will be found diseased and will require appropriate treatment. (See Prostatic and Seminal Vesicles.)

CHRONIC POSTERIOR URETHRITIS.

The posterior urethra is involved in about 80 per cent. of all cases of acute gonorrhœa. In many of these the disease never becomes chronic, but when it does, the posterior urethra remains inflamed quite as often as the anterior.

Chronic posterior urethritis may exist alone, the inflammation having run its course and ended in the anterior part of the canal, but we frequently find a chronic inflammation of both anterior and posterior portions of the urethra at the same time.

Acute posterior urethritis is almost invariably caused by gonorrhœa, but a *chronic* inflammation can be occasioned in other ways. Any cause which tends to produce a prolonged state of *congestion* in the posterior urethra which is oft repeated will, in time, lead to the establishment of a condition of *inflammation* in the mucous membrane and hyperplasia of the submucous tissues.

The causes which are usually responsible for these conditions are excessive sexual intercourse or sexual abuses, such as masturbation or coitus reservatus (withdrawal).

The habit of withdrawing the penis during the act of coitus and allowing the seminal fluid to be ejaculated outside the vagina is always followed sooner or later by chronic posterior urethritis, with its attendant train of nervous symptoms, which are known under the general term of *sexual neurasthenia.*

For all practical purposes, the symptoms and treatment of chronic posterior urethritis may be considered together, without regard to its etiology.

PATHOLOGY.

On account of the abundant supply of glands and follicles and the thickness and vascularity of the mucous membrane the pus-formation is apt to linger in the posterior urethra for years, and is very apt to attack the prostate and seminal vesicles.

The histological changes are substantially the same as in chronic anterior urethritis.

The mucous membrane is in a state of chronic inflammation, with desquamation of its epithelium, and the submucous tissues are the seat of a small round-celled infiltration, which also surrounds the mucous crypts. The infiltration, in time, becomes converted into scar-tissue and the glands are obliterated by its pressure. The infiltration, however, is not transformed into distinct *bands* of scar tissue, such as form strictures in the anterior urethra, but there is simply a *general condensation* or *fibrous hardening* of the periurethral tissues.

The sclerosis of the submucous tissue does not materially narrow the calibre of the urethra, and, consequently, stricture never occurs in the posterior urethra, except from traumatic origin.

The *verumontanum*, or *colliculus seminalis*, is always affected in chronic posterior urethritis. It is enlarged, the mucous membrane is bluish in color and softened, and the natural sensitiveness is aggravated to a high degree. This structure is the point most highly supplied with nervous filaments in the urethra, and, on account of its increased receptive influence to painful impressions, when the submucous infiltration begins to contract it compresses these nerves and occasions marked reflex disturbances.

The symptoms are often *mental*, and take the form of hypochondria, depression, irritability, and inability for sustained mental effort, or may be *neuralgic* in character and referred to distant or associated organs..

DIAGNOSIS.

The two-glass urine test is only applicable to cases where there is a considerable amount of pus-formation, in which both first and second glasses are turbid and often contain small shreds shaped like a comma or tadpole.

These are known as *Fürbringer's hooks* and are plugs of secretion which have been formed within the mouths of the prostatic ducts.

When present they denote that the general inflammation of the posterior urethra has extended by continuing into the prostatic ducts.

In the following instances the posterior urethra may be chronically inflamed and the second glass of urine will not be discolored:—

(*a*) When such a *small quantity* of pus is secreted that it does not flow back and discolor the urine in the bladder.

(*b*) When the stream of urine is feeble in force and not sufficient to wash out the mucous plugs from the crypts and follicles in the mucous membrane and the mouths of the prostatic ducts, contraction of the muscular structures surrounding the urethra is necessary to accomplish their emptying.

(*c*) The prostate gland and seminal vesicles may be chronically inflamed and yet the pus formed does not flow out freely enough to appear in the urine *unless* direct pressure is made upon those organs by means of the finger in the rectum.

The **Jadassohn-Van Zeissl method** is useful in overcoming objections *a* and *b*. The *technique* is as follows:—

The *anterior* urethra is irrigated by means of a catheter attached to a syringe or irrigator, which is carried down to the cut-off muscle.

After the anterior urethra has been thoroughly cleansed the patient urinates in a glass, and the urine contains the pus or shreds washed out from the posterior urethra. The patient then passes the remainder of his urine in another glass, which represents the condition of the urine which had accumulated in the bladder.

After both anterior and posterior urethras have been cleansed of accumulated secretions by washing out and urinating, the secretions from the prostate gland and seminal vesicles should be collected by means of **Jadassohn's expression urine test.** By means of a finger in the rectum pressure or massage is exerted upon the prostate gland and the seminal vesicles, and their contents are squeezed out into the urethra. The patient then urinates and washes out the expressed secretions into a glass. The urine in the glass containing the secretions expressed from the prostate and vesicles is called the *expression urine.*

In examining cases of chronic posterior urethritis we should always pay particular attention to the condition of the *seminal vesicles* and *prostate gland.* These organs are very liable to be affected by an extension of the gonorrhœal inflammation from the urethra, and when once attacked the gonococci are very likely to remain in them and continue to propagate for months and, indeed, in some cases, for years.

The **urethroscope** is always useful in confirming the diagnosis of chronic posterior urethritis, but should not be used until the disease has become very chronic.

If introduced prematurely into the posterior urethra it causes extreme pain and may aggravate the inflammation.

There is also some danger of its inducing epididymitis or vesiculitis. After introducing the endoscope the posterior urethra is seen to be of a purplish color and bleeds freely, and the colliculus appears like a half-ball, at the end of the tube, swollen and prominent and bluish or dark red in color.

SYMPTOMS.

If the posterior urethra alone is diseased, there is an *absence* of purulent discharge from the meatus.

In the later stages of the disease there is but very slight pus-formation, simply a congestion of the mucous membrane, with an infiltration and condensation of the submucous tissues. But in the early stages and in exacerbations, the pus-formation may be in considerable quantity, and will be easily shown by making the two-glass urine test.

On account of the chronic inflammation, the posterior urethra is always in a state of exaggerated sensitiveness, and the necessity for **frequent urination** is nearly always present. Usually the desire to urinate is so *urgent* that the patient cannot wait, but must respond at once to the call, or the urine escapes and wets his clothing.

Sexual symptoms are nearly always prominent. The sexual appetite is disturbed. There is either no inclination for coitus and, if indulged in, a condition of general nervous depression follows, or else there may be a constant desire for sexual intercourse, which is not satisfied by indulgence.

The act of coitus is not satisfactorily performed. Ejaculation occurs prematurely on account of the irritable condition of the posterior urethra, and for the same reason *seminal emissions*, or pollutions, occur at night during sleep, more frequently than is natural, and in some cases the seminal discharges may be stained with blood, which is derived either from the congested posterior urethra or else from an inflamed condition of the interior of the seminal vesicles.

Mental symptoms are a striking feature of most cases of posterior urethritis. The patients are hypochondriacal, they suffer from depression of mind, and are low-spirited, melancholy, and despondent, and in extreme cases may have suicidal impulses. In this frame of mind they fall an easy prey to quacks and charlatans, whose advertisements guaranteeing to "restore lost manhood and relieve the evils attendant upon the errors of youth," appear in the columns of the daily papers.

Reflex pains in the bones and muscles are nearly always felt; the patient is easily tired and incapable of his usual amount of mental or physical work, and presents the clinical picture of a mild form of neurasthenia. The symptoms thus grouped together are commonly spoken of as **Sexual Neurasthenia** and disappear promptly as soon as the local conditions upon which they depend are cured.

TREATMENT.

In chronic inflammation of the posterior urethra resulting from sexual excesses or abuses, the anterior urethra is not involved; but in posterior urethritis caused by gonorrhœa the anterior urethra is generally affected as well.

For purposes of treatment it is well to divide the cases of posterior urethritis into two groups:—

(**a**) **Superficial,** in which the mucous membrane and glands alone are involved in the inflammatory process.

(**b**) **Deep form,** in which, in addition to the inflammation in the mucous membrane, there is an *infiltration* in the deeper tissues.

The small round-celled infiltration is deposited here and ultimately is converted into scar-tissue. It does not contract and form fibrous bands, but merely produces a general condensation and hardening of the submucous tissue.

In the *superficial* form, where there is a considerable amount of pus-formation, **irrigation** by means of an irrigator or syringe and soft-rubber catheter introduced beyond the cut-off muscle, using albargin 1 to 1,000, nitrate of silver 1 in 10,000, or permanganate of potash or icthargan solutions, will generally check the secretion. After the suppuration has lessened **instillations** *with Ultzmann's syringe,* carried behind the cut-off muscle into the posterior urethra, of 15 drops of a nitrate-of-silver solution, beginning with 2 grains to the ounce and increasing as directed in the treatment of "Chronic Anterior Urethritis," usually causes a prompt disappearance of the remaining secretion and shreds. If it is desirable to medicate the posterior urethra without having the nitrate-of-silver solution come in contact with the interior of the bladder, it is well to make the instillation with the bladder full of urine. In that event any of the solution which flows back into the bladder is neutralized by the salts of the urine.

If, on the other hand, we wish to affect the base of the bladder as well as the posterior urethra, the bladder should be emptied of urine before making an instillation.

In many cases of posterior urethritis of long standing, when milder measures have been faithfully tried and found unsuccessful, applications of a strong solution of nitrate of silver to the posterior urethra, through the **urethroscope,**[1] may be used, and very often from four to six applications are enough to cure an obstinate case when it is uncomplicated by prostatitis or vesiculitis.

On introducing the urethroscope, the posterior urethra is found to be swollen, congested, of a purple color, and bleeding freely, and the verumontanum stands out prominently like a half-ball, and is dusky in hue.

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[1] Socin and Burkhardt, Krankheiten der Prostata, 1902.

The applications must be made directly to the colliculus and not allowed to run over the prostatic urethra. The nitrate of silver is used in the strength of 100 grains of the salt to an ounce of water.

A decided reaction with frequent painful and bloody urination always follows, but subsides in a few days, and then improvement is noted in the subjective symptoms and also in the urethroscopic appearance of the parts.

On account of the pain which the strong applications of nitrate of silver cause, Frank advises the use of pure carbolic acid when the posterior urethra is very sensitive, and later in the course of treatment he uses trichlor acetic acid, 5 or 10 per cent., or tincture of iodine and glycerine in equal parts. The iodine acts as an absorbent, while the acetic acid is a caustic.

Under the use of irrigators, instillations, or applications to the colliculus through the urethroscope, the inflammation in the mucous membrane is finally healed, and then the submucoid infiltration, if present, should receive appropriate treatment.

To accomplish the absorption of the infiltration it is necessary to use **dilatations of the posterior urethra** by means of sounds or dilators. Forcible dilatation or tearing apart of the tissues is harmful, and we should proceed with the utmost gentleness and caution in the manipulation of sounds in this region. The sound, of course, should never be passed until the free suppuration has ceased and there are only very chronic and indolent inflammatory residua remaining, on account of the danger of increasing the inflammation or of causing epididymitis.

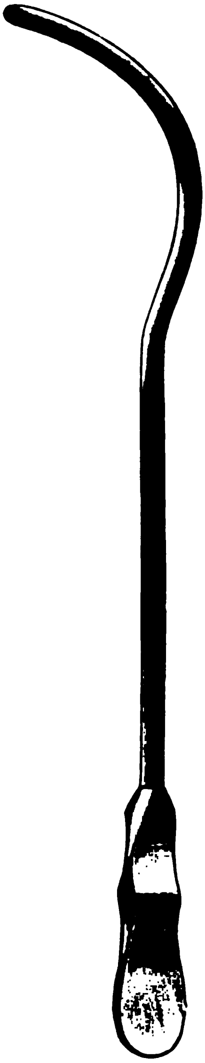

Fig. 38.—The Guyon Sound.

The **Guyon sound** is particularly adapted to the posterior urethra, on account of its shape, which is similar to that which a soft catheter assumes when it lies in the bladder and urethra. The weight of the Benique sound has some advantage, as it produces a certain amount of compression and so stimulates absorption of the infiltration, besides emptying out the crypts and follicles.

A better instrument to use, however, is the **Kollmann-Frank irrigating dilator for the posterior urethra.**

It should not be used if gonococci are present, and great care should be taken not to dilate too rapidly and so lacerate the tissues or excite epididymitis, as the tolerance to instrumentation is far less in the posterior urethra than in the anterior. During the dilatation the irrigation of the urethra should proceed with a solution of nitrate of silver, 1 in 10,000 (Frank). The advantage of the irrigating dilator over the simple is that at the time of full dilatation the urethral folds are smoothed out and the prostatic ducts are distended, so that the solution comes in contact with their open mouth.

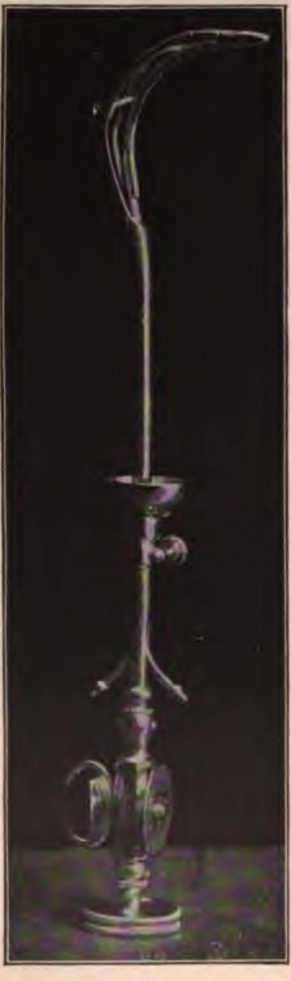

Fig. 39.—Frank's Posterior Dilator.

In every case of chronic posterior urethritis the condition of the seminal vesicles should be investigated by rectal examination. It is useless to attempt to cure an inflamed posterior urethra when a pair of inflamed seminal vesicles are discharging a quantity of gonorrhœal pus into the urethra every few days and causing an *exacerbation*. Many cases of relapsing posterior urethritis will get permanently well through a systematic stripping of the seminal vesicles, when everything else has been tried in vain.

At the same time the prostate should not be overlooked, for a follicular prostatitis is often present as a complication, and should be treated by massage through the rectum, in order to empty out the contents of the inflamed and dilated prostatic ducts.

Under the treatment above outlined the symptom-complex known as **sexual neurasthenia** rapidly clears up and generally disappears entirely, but some traces occasionally remain, even after the local changes in the posterior urethra and its adnexa have been cured.

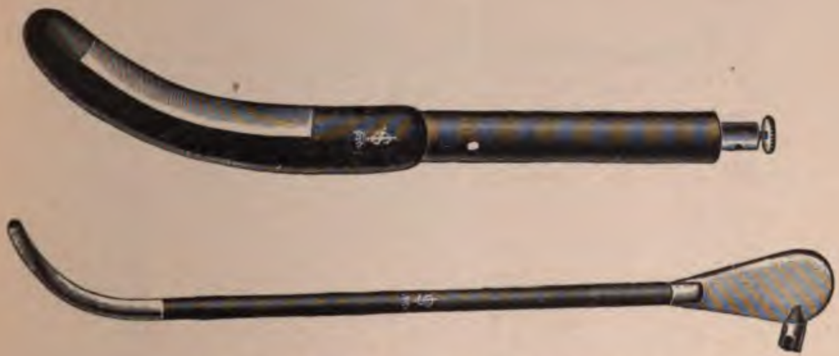

Fig. 40.—Rectal and Urethral Electrodes.

This implies that some alteration in the functional capacity of the nerves still remains, which demands treatment with **faradic electricity.**

The galvanic current should not be used, for it causes electrolysis and acts as a caustic. Frank advises the faradic current with one pole in the rectum and the other in the urethra.

The *high note* is to be preferred, as it relaxes spasm and also has a sedative action on the nerve and obtunds its sensation.

The low note stimulates flabby muscles to powerful contraction and results in increased nutrition and better tone, but the spasm is increased. (Wappler.)

URETHROSCOPY[1]

The changes which are disclosed upon examination with the urethroscope are not of a very striking nature, and a good deal of practice is required to detect the slight differences between normal and diseased conditions.

The urethroscope has only a diagnostic value in the anterior urethra, for the deep-lying infiltration and the glandular and periglandular changes upon which the disease of the mucous membrane depends cannot be influenced by applications made upon the surface.

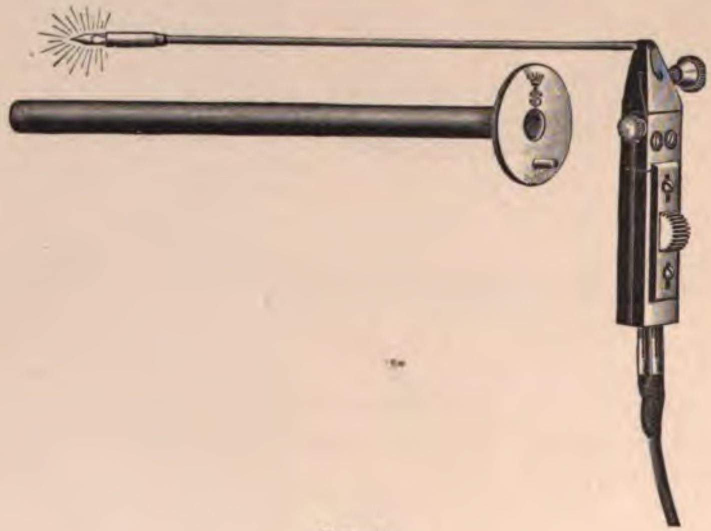

Fig. 41.

In the posterior urethra, however, the result of applications of nitrate of silver are often brilliant.

The recent invention of an electric light which gives a bright illumination without heat has resulted in a form of urethroscope with which a very satisfactory view of the urethra can be obtained.

The patient lies on a suitable table, with his feet resting on a stool. The tube with the obturator is introduced into the urethra, and when the obturator is withdrawn the electric light is inserted into the tube and carried down to its end.

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[1] For the material in the following chapter, the author wishes to acknowledge his indebtedness to Die Gonorrhœ des Mannes, by Dr. Hans Wossidlo, Berlin, 1903.

As the tube is slowly withdrawn the mucous membrane rolls over its end and can be thoroughly inspected.

Normal Appearances of Anterior Urethra.—I. Observe the surface of the funnel-shaped figure which the urethral walls assume beyond the end of the endoscope.

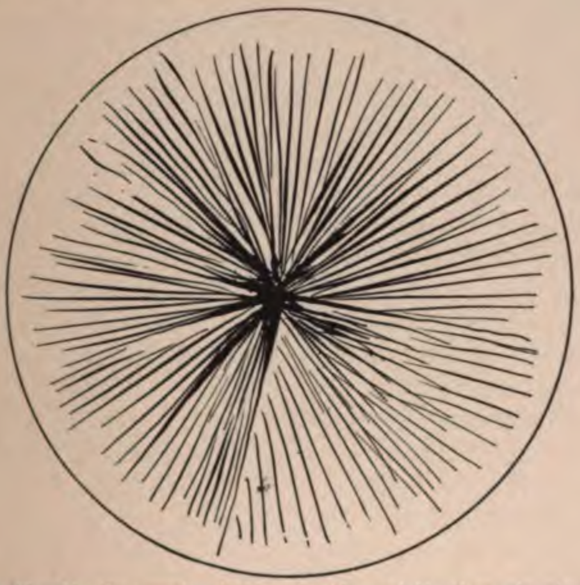

Fig. 42.—Urethroscopic picture of a Normal Urethra, showing a multitude of fine folds and small central figure.

II. The central figure: *i.e.,* appearance presented by the closed lumen of the urethra, which forms the apex of the funnel.

The folds of mucous membrane radiate from the central figure outward toward the periphery. Their thickness and number indicate if the mucous membrane be infiltrated, and are of diagnostic importance. Longitudinal red stripes running toward the central figure are also noted, and indicate a normal uninfiltrated condition of the mucous membrane.

The surface of the mucous membrane is smooth and glistening and with a distinct lustre; its color is ordinarily pale and rosy, but if normally hyperæmic may appear distinctly red or purple, without being diseased.

The openings of *Morgagni's crypts* appear in the roof of the urethra as red specks or small slits as large as a pin's head, but the ducts of Littré's glands are not visible in a normal case.

The posterior urethra presents substantially the same appearances as the anterior, except that in addition the *verumontanum* is seen upon the floor of the urethra, looking like a fold of mucous membrane.

In exceptional cases the ejaculatory ducts can be seen as little dots alongside the verumontanum.

By means of the urethroscope Oberlaender classifies chronic gonorrhœa into two groups of inflammatory processes.

I. *Soft infiltration*, which consists in a submucous infiltration of small round cells with increased development of the capillary vessels, and

II. *Hard infiltration*, which includes all the inflammatory processes through which the soft infiltration is converted into fibrous connective tissue, of which its highest degree is stricture.

The character of the diseased process will be markedly influenced by the participation of Morgagni's crypts and Littré's glands, and Oberlaender divides the hard infiltration into two forms:—

(*a*) *Glandular form*, and

(*b*) *Follicular or dry form.*

In the glandular form the ducts remain open and the glands are inflamed, while in the follicular or dry form the glands are entirely obliterated or changed into closed follicles.

URETHROSCOPIC FINDINGS IN CHRONIC ANTERIOR URETHRITIS.

Soft Infiltration.—By introduction of urethroscope, no resistance is felt, but the mucous membrane bleeds easily from contact with the tube.

The *mucous membrane* on the diseased spot appears distinctly hyperæmic and of a brighter red than on the normal spots.

The *epithelium* on the diseased spots shows an increased lustre, is softened, and desquamates easily. On isolated spots the epithelium has entirely disappeared, leaving small *erosions*, or bright red granulations which bleed easily. Particularly in the region of the bulb we find, after the rest of the urethritis is cured, granulations which are a cause of the persistent shred-formation.

The softened congested mucous membrane, as may be expected, does not lie in as many folds as normal. The long folds are obliterated, and in place of the numerous fine folds radiating from the central figure, we see only three or four broad, softened folds.

The central figure presents itself as a wide and gaping opening, with the mucous membrane often bulging into the end of the tube, or it may be a crescent-shaped slit which is nearly closed.

The inflammation of Morgagni's crypts shows itself through softening and hyperæmia of their mouths. These appear as red eminences, pinhead size, with swollen walls, and often discharge a mucous or purulent secretion.

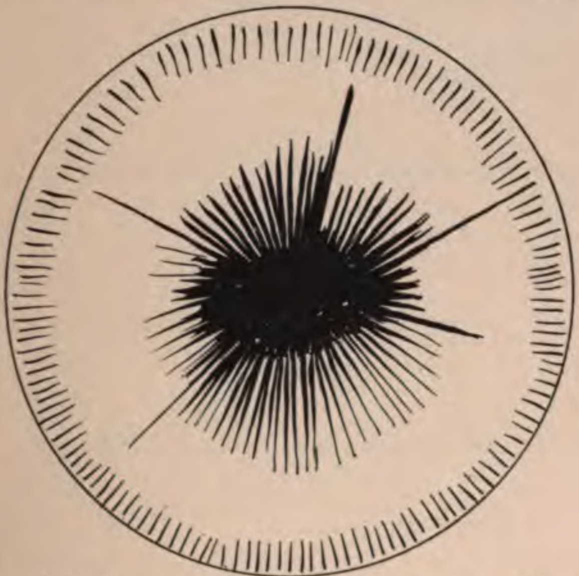

Fig. 43.—Urethroscopic picture of Soft Infiltration of the mucous and submucous tissues. The central figure is wide and gaping, and the folds of thickened mucous membrane are few in number and coarse and broad.

It is easy to secure the secretion for microscopic examination by the *secretion spatula or canula.*

When the mucous membrane is very soft and hyperæmic it is difficult to see Morgagni's crypts, and Littré's glands are never visible with soft infiltration.

Hard Infiltration.—The second stage of the chronic inflammatory process begins with the appearance of connective-tissue fibres in the round-celled infiltration, and is the so-called *hard infiltration* of Oberlaender.

In the beginning, when the amount of connective tissue present is slight, and the hyperæmia and swelling of the mucous membrane are marked, the urethroscopic appearances are those of the soft infiltration, but as the submucous connective-tissue infiltration thickens, the blood circulation in the mucous membrane is shut off and it loses its bright red color as well as its turgescence and elasticity.

In the worst cases, as a result of the connective-tissue hyperplasia and scar-tissue contraction, the mucous membrane on the diseased spots is converted into a rigid, resisting tissue.

These different phases of development give, naturally, different urethroscopic pictures.

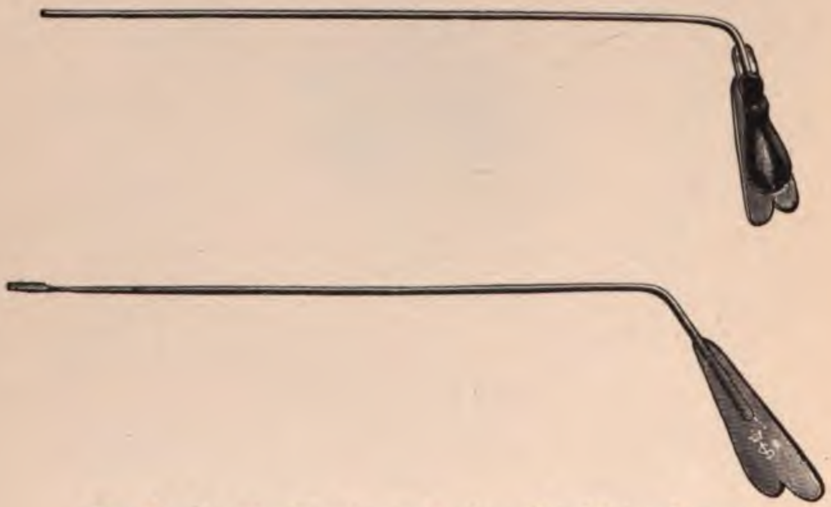

Fig. 44.—Secretion Spatula, or Canula. (Kny-Scherer Company.)

On introducing the tube one feels the resistance caused by the diminished dilatability of the walls, until as the stricture progresses, it may not be possible to introduce even the smallest tube.

A change in the *color of the mucous membrane* is also noted with the urethroscope.

When the infiltration is slight in amount, the diseased spots appear paler and more anæmic than the healthy portions; with increasing thickness of the infiltration, the color becomes grayish white or yellowish white; and by marked stricture formation, a uniform gray white appears.

Under the disturbances of nutrition the *epithelium* also suffers.

In the description of the pathological anatomy of chronic gonorrhœa, the change of cylinder epithelium into compact, many-layered, squamous epithelium and its cornification has already been described.

Slight degrees of hard infiltration are characterized by a diminution in the normal lustre and transparency of the epithelium. In consequence of the desquamation, the surface appears stippled and uneven.

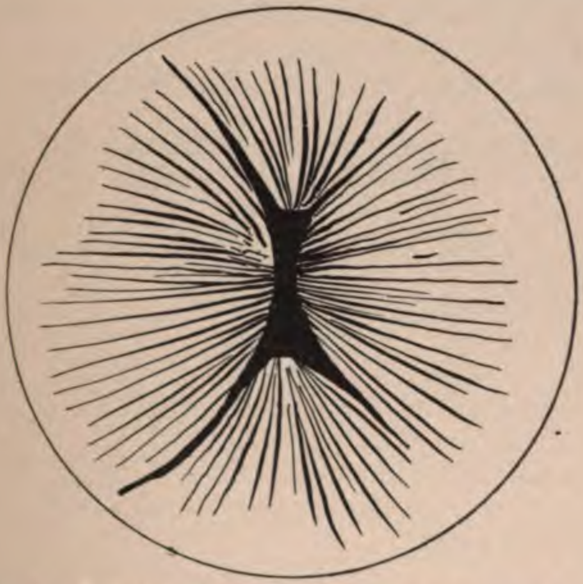

Fig. 45.—Urethroscopic picture of Hard Infiltration of the submucous tissues. The central figure is open, gaping, and very irregular in shape.

As the process extends it tends to localize itself on the most diseased spots, and in severe cases extends over a considerable area, so that finally a thick epithelial layer, or pachydermia, develops.

Under the urethroscope, the epithelial surface appears irregularly lumpy, with these high degrees of infiltration.

In other cases one finds various large, round, pearl-gray-colored spots as large as a pin's head, which rise abruptly from the mucous membrane.

As a result of the infiltration, the thickened mucous membrane is no longer able to lie in *longitudinal folds*.

By slighter grades of infiltration, four to six broad, coarse folds may be noted, and in cases where the infiltration is more marked the folds are correspondingly fewer, until in the highest grade of infiltration the folds have disappeared entirely and the urethra appears at the end of the urethroscope as a stiff, inelastic tube with smooth walls.

The shape of the central figure is changed into a star-shaped and lengthened funnel.

The above-described changes in the mucous membrane, which occur as a result of the hard infiltration, are also participated in by the urethral glands. Oberlaender divides hard infiltration as, *A, Glandular form,* and *B, Dry form.*

A. Urethroscopic findings in the **glandular form**:—

As a result of the loss of the epithelium the ducts of *Littré's glands* become visible.

Lying in groups, they appear enlarged and surrounded by an inflammatory zone.

The openings sometimes appear like craters, and secretion is seen issuing from them.

Morgagni's crypts show similar changes, and their swollen and gaping openings, with mucopurulent secretion issuing from them, appear distinctly surrounded by infiltration.

When the periglandular infiltration is so strongly marked, the ducts of the glands are elevated above the surface and are seen as small, red protuberances.

B. Urethroscopic findings in the **dry or follicular form.**

From the compression of the scar-tissue forming the periglandular infiltration, the ducts of Littré's glands are closed and the glands themselves obliterated or transformed into subepithelial cystic cavities filled with colloid masses.

The ducts of Morgagni's crypts also become obliterated and the gland contents become inspissated and thickened.

The urethroscopic picture of this form of hard infiltration is very distinctive. It is characterized by the fact that there are none at all, or very few, gland-duct openings visible.

Here and there may be seen, at the location of a duct-mouth, a small white or yellow glistening prominence, which denotes the closed follicle and can be felt by palpation of the urethra as a hard nodule the size of a millet-seed.

In proportion to the grade of the hard infiltration, the changes in the mucous membrane are more or less marked.

Longitudinal folds have more or less disappeared.

The *epithelium* appears, in this form, notably dull, without luster. and desquamates in large pieces and gives to the observer the impression of dryness.

Not infrequently both dry and glandular forms of infiltration are found side by side, and are described by Oberlaender as the *mixed infiltration.*

URETHROSCOPIC FINDINGS IN CHRONIC POSTERIOR URETHRITIS.

The same pathological alterations which have been described in the anterior urethra also occur in the posterior urethra, and can be detected with the urethroscope. One finds here, also, soft and hard infiltration, and the latter can be divided into various grades.

With the **soft infiltration** the mucous membrane is bright or bluish-red in color, swollen, bleeds easily, and the epithelium has a faint lustre.

The verumontanum is swollen and enlarged, and projects upwards into the tube. Its surface is either smooth or lumpy and furrowed, and often resembles a raspberry.

The openings of the prostatic sinuses are generally not visible on account of the swelling.

The mouths of the ejaculatory and prostatic ducts show, when they are visible, swollen walls and gaping orifices.

The **hard form of infiltration** gives changes analogous to those described as occurring in the anterior urethra, although, on account of the absence of visible glands, they are more uniform and resemble more the dry form of the hard infiltration.

The mucous membrane appears pale red or grayish yellow in color, and dry and lustreless.

If the verumontanum has been attacked by the connective-tissue infiltration, it is yellowish in color, with a dulled epithelial lustre, and is flattened and smooth on the surface.

In high degrees of hard infiltration, one finds horizontal, thread-like scars, and the parts of the mucous membrane lying above them are dry and grayish yellow in color.

UNUSUAL CONDITIONS OBSERVED WITH THE URETHROSCOPE.

In addition to the changes above described, which are commonly met with, certain conditions are sometimes seen.

Papillomata resembling the vegetations occurring on the prepuce are occasionally found. They may fill the urethra to such an extent as to interfere with urination; and if they occur in the posterior urethra, lead to marked reflex disturbances of the nervous system.

Cysts formed by the retention of secretion in the urethral glands or Cowper's glands have been observed by Fenwick, Grünfeld, and others. They are of extreme rarity.

Psoriasis mucosæ is observed as snow-white spots, not elevated above the surface, and formed of masses of pavement epithelium closely adhering together.

Changes of color sometimes result from the frequent use of nitrate of silver, and appear most often as bluish-black spots, in the vicinity of the gland openings, or even sometimes as extensive spots of discolored mucous membrane.

TREATMENT OF THE ANTERIOR URETHRA.

The urethroscope is a useful instrument for diagnosis, but is of little value in the treatment of chronic urethritis, for while granulations and erosions may be cauterized through the endoscopic tube, the submucous infiltration upon which they depend cannot be reached by a superficial application, but requires the pressure of dilatations to cause its disappearance.

The application of remedies is made to the diseased surface by means of a tampon of cotton wrapped around a stick[1] and introduced through the endoscopic tube. The principal *drugs* in use are: nitrate of silver, from 10 to 100 grains to the ounce; iodine and carbolic acid, equal parts; sulphate of copper, 25, 50, or 100 grains to the ounce; and bichloride of mercury, in 1-per-cent. alcoholic solution.

The intervals of treatment depend upon the amount of reaction; every three days for mild solutions and from five to seven days for strong ones is about the average. After improvement begins intervals should be increased to ten days. The first application should always be mild; 10 grains to the ounce is strong enough to begin with, and it may be increased later if desired.

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[1] The sticks which florists use for tying on to the ends of cut flowers answer the purpose.

In regard to the selection of the appropriate remedy, it may be said in a general way that a diffuse hyperæmia calls for milder solutions of nitrate of silver: 5 or 10 grains to the ounce. Granulations require strong solutions of nitrate of silver, from 50 to 100 grains, or carbolized iodine. For erosions mild solution of nitrate of silver, 5 or 10 grains to the ounce, is the best, while for inflamed glands carbolized iodine answers well.

Sometimes a localized area of granulations in the bulbous region may cause a continuance of the discharge, and in these cases, which do not clear up after dilatation, topical applications through the endoscope of a 10 to 20 per cent. nitrate-of-silver solution rapidly destroys the granulations.

Morgagni's crypts are often the seat of a chronic inflammation, and afford opportunity for the growth of colonies of gonococci, which cause relapses of an apparently cured gonorrhœa. They can be disposed of like any other suppurating sinus, by laying them freely open on the floor, using the galvano-caustic needle, through the urethroscope under the guidance of the eye.

Papillomata of the urethra can be removed by a wire loop or destroyed by electrolysis.

In the **posterior urethra** local treatment through the endoscope is often indispensable.

The prostatic urethra requires the strongest applications of nitrate of silver; but under inspection, if the lesions do not improve, the strength of the solutions can be increased or their character changed, as occasion requires.

In chronic posterior urethritis, with a good deal of inflammatory swelling of the verumontanum, cauterizing it with a 20 per cent. nitrate-of-silver solution (100 grains to the ounce), as advised by Burckhardt, often gives brilliant results, and the various reflex nervous disturbances disappear very rapidly.

Tincture of iodine and glycerine, equal parts, may be used as an absorbent, and when the nitrate of silver causes excessive pain, Frank advises the use of trichlor acetic acid, 5 or 10 per cent., as a caustic.

RESUMÉ OF THE DIAGNOSIS, PROGNOSIS, AND TREATMENT OF CHRONIC URETHRITIS.

In examining a case of chronic urethritis, it is desirable to proceed in a systematic way, so that important points may not be overlooked, and the author finds the following scheme a satisfactory one in practice.

The **patient's history** is first obtained, and the number, duration, and attendant complications of previous attacks of gonorrhœa are noted.

The surgeon next inquires about the *present attack,* ascertaining how long it has lasted, what treatment has been used, the amount of discharge, and whether frequent and urgent urination is present. The patient is asked about his *mental symptoms,* whether he is despondent, irritable, and depressed.

The *sexual symptoms* are inquired into, and the patient is asked if, on coitus, the ejaculation is premature and if the erections are firm, also if seminal emissions occur and how frequently, and if by night alone or in the day as well. (Prostatorrhœa, spermatorrhœa.)

The physical examination is then begun, and the *testicles* are examined for varicocele, epididymitis, or orchitis. The *meatus* is inspected, to see if it is too small or if hypospadias is present.

Smears of the pus discharging from the urethra are made on two cover-glasses.

The patient is then requested to pass a small quantity of urine in a glass.

The contents of **glass 1** are observed, to note if the urine is turbid or clear and contains clap-shreds. If the urine is turbid from *phosphates,* the addition of a few drops of nitric acid will cause it to clear up.

If the urine, however, is turbid from *pus,* it is an important contraindication to any urethral instrumentation, and the patient is put on irrigations until the pus disappears and the urine is clear, with shreds floating in it. When this result is attained it is proper to begin instrumentation of the urethra, and not before.

If the bladder contains a sufficient quantity of urine upon the first visit, the two-glass urine test may be made, and the contents of **glass 2** noted. The presence of pus in the second glass indicates involvement of the posterior urethra, although in certain conditions the Jadassohn-Van Zeissl method must be used to determine this point.

If there is only a small quantity of urine in the bladder, we can omit securing glass 2 and proceed directly to the **examination of the rectum.**

With the patient in the leap-frog position, the *prostate* is examined, to ascertain whether it is enlarged, and, if so, whether it is *hard* or *soft*. The upper border is sought for, to find or exclude perivesiculitis.

The condition of the *seminal vesicles* is ascertained, and the surgeon notes if they are soft and distended, or hard and painful.

The contents of the seminal vesicles and prostate are then stripped or expressed and squeezed through the ejaculatory and prostatic ducts into the posterior urethra.

Immediately after the stripping the patient urinates into a glass, thus washing out of the urethra the secretions of the prostate and vesicles which have just been expressed. This mixture of prostatic and vesicle secretion and urine is termed **expression-urine** and is always carefully inspected. If the protate and vesicles are healthy, the expression-urine is only slightly milky in color, but if these organs are diseased, the expression-urine contains heavy masses, shreds, or free pus, which sinks to the bottom of the glass on standing.

Instead of collecting the expressed prostatic secretion in the urine, it may be caught on a glass slide and, after drying, stained and examined with the microscope.

The author believes that obtaining a kuowledge of the condition of the prostate and vesicles is the most important step in the whole examination, for these structures may harbor gonococci for months, and possibly for years.

Disease of these organs is responsible for innumerable cases, where innocent wives have been infected with gonorrhœa by their husbands, the causation of impotence, and, in the light of recent pathological research, may perhaps be the cause of the enlargements of the prostate which occur in old men.

The expression-urine should always be examined microscopically.

If normal, the sediment is found to contain mucus, granular phosphates, and spermatozoa. Sometimes amyloid bodies and phosphatic concretions are present, and Boettscher's crystals appear on adding 1 per cent. solution of phosphate of ammonium.

Disease of the prostate and vesicles is denoted by the presence of pus-cells. Gonococci may or may not be found; but if much pus is present, the likelihood of the existence of gonococci is very strong.

The next step in the examination consists in **exploring the urethra,** provided the urine is clear and contains only floating shreds.

The *urethrometer* may be used for two purposes, but the author prefers a flexible *bulbous bougie,* with which a hard or soft infiltration can be easily recognized.

The findings of the bulbous bougie may be confirmed and additional light thrown on the case by the **urethroscopic examination.**

The most important pathological feature of chronic urethritis is the *infiltration,* for the erosions and glandular changes depend upon it. With the urethroscope we are able to determine if the infiltration is hard or soft, and we can also observe the presence of erosions, glandular changes, and granulations.

The posterior urethra is more difficult and more painful to examine than the anterior. The chief points of interest are the verumontanum and the color of the mucous membrane, which in diseased conditions is purple and rough and bleeds freely.

After completing the examination of a patient in the manner thus detailed and deciding what parts are affected; if the anterior urethra alone is involved, or if both anterior and posterior urethras are affected, and complicated perhaps by prostatitis or vesiculitis, we are in a position to begin the treatment of the case.

In most cases of chronic urethritis we find that there is a chronic inflammation, with more or less infiltration, affecting both anterior and posterior urethras, and that in addition the prostate is generally involved, and frequently the seminal vesicles as well.

METHOD OF EXAMINING A CASE OF CHRONIC URETHRITIS.

First Day.

History: Take in detail.

I. Inspect pus squeezed from meatus.

II. Examine urethra with bulbous bougie or urethrometer.

Second Day.

III. Wash out shreds and secretion from anterior urethra.

IV. Patient urinates in glass No. 1. No. 1 contains washings from posterior urethra.

V. Examine prostate and seminal vesicles per rectum.

VI. Patient urinates in glass No. 2. No. 2 contains expression urine from prostate and seminal vesicles.

VII. Examine shreds and pus secreted by urethra, microscopically.

Third Day.

VIII. Examine urethra with endoscope unless a considerable portion of the mucous membrane is inflamed and secreting pus freely.

PROGNOSIS.

The duration of chronic urethritis is always protracted and requires great patience on the part of physician and patient. From the experience of the leading genito-urinary specialists in this country and Europe, as developed by the results of the investigations of the committee of the American Medical Association, six months may be accepted as the average duration of the treatment of chronic gonorrhœa, while in the experience of some of the reporters about 3 per cent. of the cases were incurable by any treatment whatever.[1]

The test as to when the patient is cured is the *permanent absence of pus-cells* and *gonococci in the urethral secretions.*

When all discharge has ceased from the anterior urethra, in order to get material for microscopic examination it is necessary to inject a syringeful of 2-per-cent. nitrate-of-silver solution into the anterior urethra. A free discharge of pus follows, which ceases in twenty-four hours. If no gonococci are found in the resulting secretion after microscopic examination of several smears, it is safe to conclude that the micro-organisms have all been eliminated from the urethra in front of the cut-off muscle.

The secretions of the prostate and seminal vesicles should be expressed by the finger in the rectum and examined at the same time. It is from these organs that the chief danger of infection comes after discharge has ceased from the meatus, and they are responsible for the majority of cases of infection of wives and mistresses. In examining the expressed secretions from the prostate and vesicles it is not enough to demand absence of gonococci; we should insist upon an *absence* of *pus-cells,* for if pus-cells are present there may be an occasional gonococcus in a cell which might easily be overlooked..

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[1] Social Diseases and Marriage, Morrow, 1904.

It is estimated that one-eighth of all the diseases of women are occasioned by gonorrhœal infection attacking the vagina or cavity of the uterus, and thence extending to the Fallopian tubes and ovaries. In view of these facts, a patient who has suffered from chronic gonorrhœa should only be allowed to marry when examination shows:—

I. Absence of gonococci.
II. Absence of pus-cells.
III. Freedom from stricture.
IV. A healthy normal condition of prostate and seminal vesicles.

Certain cases of chronic urethritis suffer from *excess* of *treatment,* and the inflammation is maintained by the irritation produced by the local applications.

After a case has been under treatment for a couple of months, it is always desirable to stop all injections or instillations for ten days in order to make sure that the natural process of recovery is not retarded by overtreatment.

Entire disappearance of *shreds* is not to be looked for. The erosions have been covered with many layers of squamous epithelium and continuance of desquamation of the upper layers goes on as the new cells are formed in the depths.

The shreds appear as thin filaments which float in the urine, and microscopic examination shows them to be composed of squamous cells alone without containing any pus-corpuscles.

TREATMENT.

In beginning the treatment of a case of chronic urethritis, the condition of the urine indicates the therapeutic measures to be adopted. If the urine is cloudy and turbid from pus in both glasses, as is generally the case, urethro-vesical irrigations should be used until the urine no longer contains pus, but only shreds.

If gonococci are still present, the best drug to use is albargin, 1 to 1000.

If gonococci are not evident and the discharge is scanty and the urine is clear, with shreds, nitrate of silver, 1 to 4000, may be used, and if gonococci are present the discharge will be increased at once. If there is a considerable amount of suppuration without gonococci, permanganate of potash, 1 to 3000, is a suitable remedy.

In the author's experience, a subacute urethritis with a *moderate amount of discharge* from the urethra is usually best treated by albar-

Sophol Schering & Glatz.

gin, 1 in 1000, or 1 in 3000 permanganate irrigations, while a *slight discharge* of pus or the presence of *abundant heavy shreds* requires irrigations every second day with nitrate-of-silver solution from 1 in 10,000 to 1 in 2000.

After continued irrigations, when the urine has become *clear with shreds* floating in it, it is proper to begin *dilatations,* with the object of causing absorption of the round-celled infiltration. The infiltration exists in greater or less degree in practically every case of chronic urethritis, and must be gotten rid of, to prevent stricture and allow the superficial lesions to heal.

It is better to begin the dilatation with *sounds,* after cutting the meatus if necessary. When the limit has been reached with a sound, which is from 28 to 32, the treatment should be continued with the *Kollmann dilator.* After each dilatation, the urethra should be irrigated with 1 to 4000 nitrate-of-silver solution.

Instead of using the sounds, dilatations with the Kollmann irrigating dilator may be begun at once.

While treating the urethra, it is highly important not to overlook the prostate and seminal vesicles, for the prostate is affected in nearly every case of long standing, and very frequently the seminal vesicles as well.

The prostate and vesicles should be massaged regularly, twice a week, to empty the prostatic tubules of inflammatory products and to cause the absorption of the perivesicular infiltrations.

After each massage or stripping, an intravesical irrigation of nitrate-of-silver solution, albargin, or oxycyanat of mercury, or in very chronic cases an instillation into the posterior urethra with an Ultzmann's syringe, should be employed.

Massage of the prostate and dilatations of the urethra should not be used on the same day, on account of causing too much irritation.

The surgeon should also remember that treatment of any kind, if continued for too long, causes in itself that which maintains the disease in the urethra. It is always well to stop all treatment for a few days, every two or three months.

The treatment as above outlined, consisting in irrigations and dilatations of the urethra, with massage of the prostate and vesicles, will be all that is required in most cases. When, however, a patient fails to get well, it usually implies that some focus of infection, often in one of Morgagni's crypts, is still present which has been overlooked, that a constitutional diathesis exists, or the treatment has been incorrectly applied.

The patient should clearly understand before beginning treatment that it will require from three to six months before he is cured, for if he knows at the outset the length of time needed he will be less apt to grow impatient at the apparent slowness of his progress and abandon treatment before he is well.

CONSEQUENCES OF UNCURED GONORRHŒA.

I. TO THE MAN.

(*a*) *Local.*

The more remote effects of gonorrhœa have an important influence on the general economy. The local lesions of prostatitis and seminal vesiculitis are followed by a train of nervous symptoms and attended by a condition of impotence; epididymitis generally results in sterility; if a stricture occurs in the urethra, it may be followed by impotence and all the serious consequences of obstructed urinary outflow, and in the most recent times some connection is thought to exist between a gonorrhœa and the development in old age of a hypertrophied prostate.

(*b*) *General affections.*

The discoveries of the last few years in connection with the gonococcus have demonstrated that gonorrhœa is not a purely local disease, but it may be regarded as a systemic general infection, with local manifestations, for the gonococci are carried through the lymphatics and deposited in various serous membranes. A common manifestation of this infection is noted in the inflammation of white fibrous tissue of joints and the endocardium and pericardium, but the meninges of the brain and cord may also be attacked.

The kidney also suffers and a pyelitis may develop, either as a result of the direct local extension from the urethra, or perhaps from hæmatogenous infection.

The *duration* of gonorrhœa depends on the longevity of the gonococcus, and this organism may live for years after its first introduction into the body.

Morrow reports one case of contagion four years after infection, and another one after six years.

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[1] Social Diseases and Marriage, 1904, Prince W. Morrow.

II. EFFECTS UPON THE FEMALE.

The consideration of the effects of gonorrhœa upon the female may be considered under three heads:—

(*a*) The increased risk to the life and health of the woman.

(*b*) The effects in inducing sterility.

(*c*) The effect upon the infant, in causing abortion, premature birth, opthalmia, neonatorum, and blindness.

The medical profession has not accepted its share of responsibility for these results!

Physicians are too apt to allow a patient showing but slight symptoms to marry, either from careless examination or an unwarrantable ignorance of the symptoms of an uncured gonorrhœa and its serious consequences to the wife and mother.

In most cases of postmarital infection, the men have honestly believed themselves cured, and in many cases they have been assured that it was safe for them to marry.

The physician fails in his duty if he does not satisfy himself, by rigorous and exhaustive tests, of the patient's freedom from contagion before he sanctions marriage, and if he does not enlighten the patient fully and thoroughly as to the dangers to which he will expose his wife from the terrible complications of gonorrhœa, until he can carry out his intentions with safety.

Long before the discovery of the gonococcus, Noeggerath recognized the pathogenic influence of gonorrhœa upon the pelvic organs of women, and boldly incriminated latent gonorrhœa in men as the active factor in the production of these inflammations and the oft-resulting sterility.

At the time, his views were held to be wild vagaries, but at the present day we know that he was right.

While the pathogenic organism is the same in man and woman, the effects of the activity of the gonococcus are differently shown, on account of the material differences in the female genital organs. The greater extent of the tract in women permits a larger field for infection, by continuity of tissue.

The situation of the uterus and ovaries in the pelvic cavity, and their proximity to the peritoneum, all increase the gravity of the infection with the gonococcus. This is also further modified by the periodical congestion at the menstrual period, and especially the changes induced by the puerperal state.

The source of infection in women is almost invariably *chronic gonorrhœa* in the man, for the reason that in acute gonorrhœa coitus is painful, and also because most men have enough conscience to abstain from intercourse during the acute period.

In chronic gonorrhœa, however, the symptoms are very trifling and may be easily overlooked.

The infection may take place in the vagina, but more frequently the organisms are deposited in the cervix at the time of ejaculation.

The inflammation remains localized for a time, until the congestion of the menstrual period or pregnancy determines the extension of the process.

The inflammation then ascends, and the endometrium, tubes, ovaries, and eventually the peritoneum are in turn attacked.

The disease is insidious while in the endometrium, and often occasions only trifling symptoms, and the woman is entirely unconscious that she has a serious infection until the tubes or ovaries are attacked.

Another reason why the infection is overlooked, is because in men the gonococci, after propagating for months upon the same soil, lose their extreme virulence, and when transplanted to the female their action depends upon the accident of their location.

If their new habitat is the urethra, they find a favorable soil and develop active inflammatory symptoms; if the primary infection is in the cervix, they are more apt to pursue a torpid, slowly-poliferating character, for the reason that some special excitation is required to arouse them from their dormant, inactive state and endow them with exalted virulence.

The determining cause is found in the function of menstruation, which causes congestion and increased flow of mucous secretion, and the lochia constitutes an excellent culture-medium for the gonococcus.

It is a well-known fact that a woman with gonorrhœa may be innocuous as far as contagion is concerned during the intermenstrual period, but becomes highly contagious immediately after the menses.

When the gonococci gain entrance to the body of the uterus or endometrium proper, general symptoms develop which are more or less pronounced, and with marked exacerbations at each menstrual period, and attended with an increase in the menstrual discharge for some days after the period.

As a result of the changes briefly mentioned, sterility occurs in 50 per cent of the cases, and a condition of invalidism is brought about, which makes life a burden and deprives the home of her influence and care.

The conditions above outlined are discussed fully in the treatises on gynæcology, but it seems appropriate, before dismissing the subject of gonorrhœa, to call attention to the conditions which may arise, through ignorance or carelessness on the part of a physician when consulted by a candidate for matrimony.

INFLAMMATIONS OF THE PROSTATE.

CHAPTER VII.

ANATOMY OF THE PROSTATE.

THE prostate in shape and size resembles a horsechestnut, and is situated below the bladder and perforated by the prostatic urethra. It is surrounded by a dense, fibrous capsule, which sends thin septa inward, between the glands and among the muscle fibres.

The prostate is essentially a *glandular organ* and is composed of two elements:—

(*a*) A fibrous connective-tissue framework, and unstriped muscular fibers; and

(*b*) Glands, composed of compound branching tubules lined with secreting epithelium and ending in short *ducts*.

Small, oval bodies are occasionally found within the tubules, which are known as *amyloid bodies*. They are formed from the secretion of the prostatic tubules and broken-down cells; later they may become calcified and form *prostatic concretions*.

The glands are arranged in distinct groups, forming three lobes.

The ducts empty as follows: Those from the lateral lobes empty at the sides of the verumontanum, and those coming from the posterior lobe empty between the verumontanum and the bladder.

The prostate is tunneled by the ejaculatory ducts from the seminal vesicles, and which empty by a slit-like orifice into the posterior urethra, within or at the sides of a small depression at the base of the verumontanum.

SECRETION OF THE PROSTATE.

The prostatic secretion is a thin fluid, milky in appearance and alkaline in reaction, with a peculiar odor which it imparts to semen.

It serves to dilute and render less viscid the secretion from the testicles and seminal vesicles, and exerts a nutritional influence upon the spermatozoa, for observation has shown that the spermatozoa do not become mobile until they have come in contact with the prostatic fluid.

Whether this is due to a mere mechanical dilution of the semen, admitting free movements of the spermatozoa, or whether the prostatic fluid has some direct effect on their nutrition, is still under discussion. Under the *microscope* the normal prostatic fluid is found to contain cylindrical cells, some granular phosphates, and a little mucus.

On adding a 1-per-cent. watery solution of ammonium phosphate, *Boettscher's crystals* appear.

These are transparent, dagger-shaped crystals, and Fübringer claims that their base exists only in prostatic fluid.

In consequence, the presence of these crystals after the addition of 1-per-cent. ammonio-phosphate solution denotes that the fluid is derived from the prostate.

ACUTE PROSTATITIS.

ETIOLOGY.

Acute inflammation of the prostate is always due to its infection with micro-organisms.

Ninety per cent. of the cases occur in the course of an acute gonorrhœa, from an extension of the posterior urethritis and entrance of organisms into the prostatic ducts.

Acute prostatitis is more common than is generally supposed.

Frank[2] examined 651 cases of gonorrhœal urethritis; of these 210 had posterior urethritis, and in every one of these the prostate was diseased.

Acute prostatitis may develop early in the course of gonorrhœa. In 96 of Frank's cases it developed in the first week.

The micro-organism which is responsible is generally the gonococcus. In 210 cases of Frank the gonococcus was found 179 times, other bacteria 20 times, and an aseptic secretion with numerous leucocytes was found in 11 cases.

Acute prostatitis may develop in the course of a chronic gonorrhœa, as a result of forced injections, injury with sounds, excesses

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[1] In the consideration of the acute and chronic forms of prostatitis, no reference will be made to the senile hypertrophy of the prostate, which occurs in old men and which is considered later in a separate section.

[2] Medical News, April 26, 1902.

in alcohol or venery, active bodily exercise, or a chilling of the surface from exposure to cold or wet.

These causes all operate either by forcing organisms into the prostatic ducts, or lowering the local resistance of the tissues to infection.

In a very small number of cases acute prostatitis occurs as a result of the passage of the colon bacillus from the rectum or in the course of infectious disease by *metastasis*.

Acute prostatitis occurs in *three forms*:—[1]

I. Catarrhal prostatitis.

II. Parenchymatous prostatitis.

III. Suppuration of the entire prostate.

It was formerly the custom to speak of **congestion of the prostate,** but this term is very vague and indefinite.

We do, however, meet with cases in which, in the course of a gonorrhœa or after the introduction of a catheter, a distinct and painful enlargement of the prostate occurs, which is by some authors termed *congestion*. It is probably due to a small, round-celled infiltration, with serous exudation into the parenchyma, and subsides rapidly by absorption.

I. CATARRHAL PROSTATITIS.

PATHOLOGY.

In this form of prostatitis, the prostatic tubules are *dilated,* their epithelial lining is infiltrated with round cells, and is the seat of catarrhal inflammation. The cavities of the tubules are filled with desquamated epithelium and altered catarrhal mucus.

The intertubular substance of the prostate, the fibromuscular tissue, is the seat of a small, round-celled infiltration and serous exudation.

The above changes all lead to an enlargement of the entire organ, and on pressure a turbid white secretion (pus) is expressed.

Healing occurs by absorption of the fluid serous exudate, throwing off of the degenerated epithelium through the prostatic ducts, and regeneration of the epithelium.

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[1] In the chapter on Acute and Chronic Prostatitis the author has made free use of the valuable monograph on the prostate by Socin and Benkhardt, published by Enke, Stuttgart, 1902.

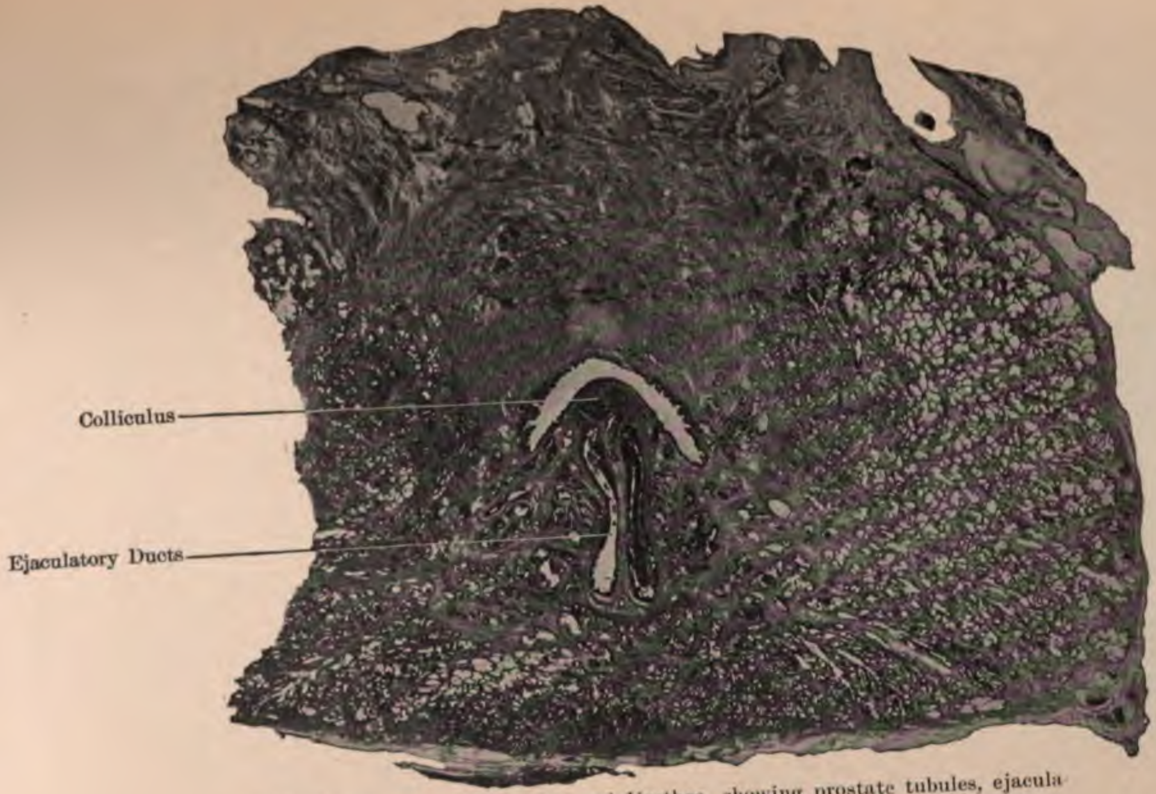

Fig. 46.—Section of Prostate and Urethra, showing prostate tubules, ejaculatory ducts, and colliculus. (Courtesy of Dr. Hein, Berlin.)

SYMPTOMS AND COURSE.

The symptoms of this condition are not very well marked, and they are still further masked by the existing posterior urethritis. The patient complains of a sense of weight and heat in the perineum and pain on defecation and urination. The fever is usually slight, but may be considerable.

On *examination* with the finger in the rectum, a hard, tense, sharply-defined swelling is observed, and the borders of the prostate can be distinctly outlined.

The increase in size is variable, sometimes only one lobe is affected, and at other times the gland is not perceptibly enlarged and the diagnosis is only made by sensitiveness on pressure.

Catarrhal prostatitis generally heals through a discharge of the pus from the small abscess cavities into the urethra, and is followed by their subsequent cicatrization and closure.

Occasionally small foci of pus can become inspissated or calcified.

The process may heal entirely or become chronic.

II. PARENCHYMATOUS PROSTATITIS.

This affection may begin as a *catarrhal prostatitis,* and increase, or begin at once as a parenchymatous inflammation.

PATHOLOGY.

Yellow foci of infiltration form near and between the glandular elements, which, after necrosis of the tissues, liquefy and form a few or many small miliary abscesses. These abscesses are sometimes absorbed, but more generally discharge their contents into the urethra, and the abscess cavities heal by formation of ciatricial scars, which contract and obliterate them.

Sometimes the abscess cavities do not close, but remain open permanently and communicate with the urethra by a fistula.

The cavity is the seat of chronic suppuration, and is prevented from healing by being filled with urine at each act of urination.

III. SUPPURATION OF THE ENTIRE PROSTATE.

This condition is always preceded by a parenchymatous prostatitis, but instead of a spontaneous discharge of the small abscesses, several coalesce, form a large abscess, and destroy the entire lobe by a necrosis of the parenchyma.

The entire organ may be destroyed, so that it is converted into a pus-sac, whose wall is formed by a fibrous capsule.

Such large abscesses generally break in the urethra, but sometimes outward in the neighboring connective tissue.

COURSE.

The fever is continuous and high. The pain in the perineum and rectum is very severe, and radiates to the penis, loin, and hips.

The pain is increased by pressure, and sitting is impossible.

There is a constant feeling as though a foreign body, like a nut, were in the rectum, which causes expulsive efforts on the part of the muscles and occasions rectal tenesmus.

If the enlargement of the prostate is considerable it can be felt on examination, bulging into the rectum as a diffuse, ill-defined, doughy or fluctuating swelling.

The protrusion of the prostate into the rectum causes the stools to be flat or ribbon-shaped.

Urination is often extremely painful, and if the greater part of the enlargement is directed upwards toward the urethra, the prostate presses upon it and causes *complete retention* of urine.

The swelling and enlargement of the gland reaches its height about the seventh day, and may terminate in the absorption of the inflammatory products and resolution; or, if the abscesses are small, they may discharge into the urethra and their walls undergo cicatrization.

In the cases which undergo *resolution* there is a gradual improvement in the symptoms. On the other hand, if *suppuration* takes place, an abscess forms in the center of the gland, and the formation of pus is announced by a throbbing pain in the perineum and chills, followed by fever and sweating. If operative measures are not resorted to, the pus bursts through the capsule of the prostate and the abscess empties itself into (*a*) the urethra, (*b*) the rectum, (*c*) or through the perineum, (*d*) or may take an eccentric course.

The pus has been known to burrow its way through the abdominal cavity and finally empty through the inguinal region, the umbilicus, the sciatic foramen, at the edge of the false ribs, through the space of Retzius, etc.

Legond reports 102 cases of parenchymatous prostatitis which ruptured as follows:—

35 times in the urethra,
  28 times spontaneously,
  7 times after passing catheter.
18 times into rectum alone.
21 times into urethra and rectum.
28 times in various regions.

In favorable cases the fistulous opening may close by granulation, but fæces, urine, or pyogenic germs may easily enter the fistula, and urinary infiltration, septic infection, and pyæmia are not infrequent results. A perforation in the rectum or urethra may leave a permanent fistulous opening, with its attendant annoyances.

Parenchymatous prostatitis is a disease which is dangerous to life itself.

Legond's statistics of 114 cases show: 70 recoveries, 34 deaths, 10 persisting fistulæ.

DIAGNOSIS.

Parenchymatous prostatitis may readily be overlooked, and the case regarded as one of posterior urethritis, which is always present and has similar symptoms, *unless rectal examination is made,* by which the enlargement of the prostate can be easily felt.

The prostate feels large, tense, and very painful. After a considerable portion of the gland has suppurated, a sense of fluctuation is usually perceived, but pus is present long before it can be detected by the examining finger.

A significant symptom of prostatic abscess, according to Alexander, is the *occurrence of a large amount of albumin in the urine,* entirely out of proportion to the amount of pus or blood present, and without existing renal disease, which disappears promptly on opening the abscess.[1]

The probable explanation is, that on account of the pressure on the veins, the blood-serum is squeezed out into the posterior urethra and flows back into the bladder.

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[1] Medical News, May 31, 1902.

TREATMENT.

The indications are:—

I. To lessen the severity of the posterior urethritis.

II. To prevent suppuration of the prostate.

III. If pus forms, to evacuate it promptly by incision.

The patient is put to bed, sandal-wood oil is administered, and the pain and tenesmus controlled by opium. Locally either an ice-bag or hot poultices are applied to the perineum, a safe guide for the choice between hot and cold applications being the sensation of comfort afforded to the patient.

Continuous irrigation of the rectum with hot water, for half an hour at a time by means of Kemp's tube is often useful, or Frank's rectal tube may be used instead. The instrument is introduced into the rectum and six or eight quarts of water, as hot as can be borne, are allowed through it.

If retention of urine should occur, the catheter must be introduced, but only when absolutely necessary, and before catheterizing the urethra should be well irrigated to free it from pus, which might be pushed ahead of the catheter into the bladder.

If great difficulty is experienced in introducing the catheter, it is proper to anæsthetize the patient with ether and leave the catheter tied in the bladder, to obviate the difficulty of reintroduction. In extreme cases aspiration of the bladder above the pubes may be demanded.

In all cases in which the symptoms do not improve within the *first week,* but, on the contrary, the fever continues, the local symptoms grow worse, and rectal examination shows an increase in the size of the inflamed prostate, one can be sure that *abscess* is forming.

This serves as an *urgent indication* to give vent to the pus and allow it to discharge; for if the pus is allowed to burst through the capsule of the prostate spontaneously, it may burrow through the tissues and cause urinary infiltration and pyæmia, or at least a fistula, which does not heal without operation.

For this reason surgical measures should be resorted to.

VARIETIES OF OPERATION.

I. *Dittel's Operation.*—This was formerly the classical procedure and was, until recently, generally performed.

Technique of Operation.—The patient is anæsthetized and a sound introduced through the urethra into the bladder. A semilunar incision is made through the skin of the perineum, curving around the rectum in order to avoid wounding it. The incision is deepened by dissection until the capsule of the gland is reached and opened and the pus evacuated. The wound is packed and allowed to heal by granulation.

This operation gives free access to the prostate and permits the ready evacuation of the pus, but it has certain disadvantages.

The wound is very extensive and takes a long time to heal, and from the proximity of the rectum below and the urethra above it is certain to be infected.

II. Another operation, suggested by Alexander, Fuller, and others, commends itself on the ground of simplicity, and also because the incision is in the line of the course which the pus takes when spontaneously evacuated.

Technique.—An external urethrotomy is done on a grooved staff, and the posterior urethra dilated with the finger. The collection of pus in the prostate is easily felt and the pus evacuated by tearing through the mucous membrane of the posterior urethra and opening up the abscess cavity with the right finger. The prostate should be held steadily by means of the left forefinger in the rectum.

The bladder is subsequently drained with a large soft-rubber catheter for several days.

The patient is allowed to get out of bed in a week, and at the end of the second week is able to pass all his urine through the urethra.

If a pus collection is not found, Fuller advises a simple division of the prostate into two halves along the floor of the urethra and the bladder.

If pus forms later, it is thus afforded a means of escape and the bladder is drained for ten days with a tube.

III. Another procedure which is only applicable to those cases where operation has been delayed and the abscess is seen obviously pointing in the perineum, is, with the finger in the rectum as a guide, to thrust a narrow straight bistoury directly into the fluctuating mass, through the skin of the perineum, and evacuate the pus.

When spontaneous rupture of a prostatic abscess has occurred, and one or more fistulæ exist, they usually communicate with the bladder and are kept from healing by the urine flowing through them. These fistulous tracks can only be cured by preventing the leakage of urine by means of an external urethrotomy and bladder drainage, at the same time laying open, or at least curetting, the suppurating sinuses.

The above remarks apply particularly to the treatment of cases where a large area is involved in the suppurative process.

When a very **limited area of suppuration in the prostate** is present, involving perhaps two or three of the prostatic tubules, the temperature is only slightly elevated and the local symptoms are not marked.

After two or three days the temperature becomes normal and the tenesmus and frequent urination disappear.

In such cases an incision into the prostate is not required, for the minute abscess generally ruptures into the urethra and the sinus fills in by granulation.

Wossidlo advises beginning regular massage of the prostate two or three times a week, followed by irrigation as soon as the abscess has discharged its contents into the urethra.

In this way it is possible to press out the pus, keeping the abscess cavity empty and allowing it to heal.

CHRONIC PROSTATITIS.

Chronic postatitis is perhaps the most important complication of gonorrhœa, for the reason that the gonococcus, with all its infectious qualities unimpaired, may be retained for years in the two diseased tubular glands of the prostate without its presence being suspected.

Chronic prostatitis is also of moment on account of the profound disturbance to the general nervous system, and impairment of the sexual function, which it usually occasions.

In almost every case of chronic gonorrhœal urethritis the prostate is found to be involved.

Chronic prostatitis frequently originates as an attack of acute catarrhal prostatitis, which becomes chronic; or it may be the result of a slow, insidious extension through the prostatic ducts of an inflammation from the posterior urethra. In the latter case the posterior urethritis was not of necessity due to gonorrhœa, but may have originated as a result of sexual excesses or abuses, such as masturbation, "withdrawal," etc.

PATHOLOGICAL ANATOMY.

An opportunity has seldom been afforded for exact observations of the changes in chronic prostatitis. The findings in the few cases where autopsies have been made, notably by Fürbringer, are as follows:—

Gross Appearances.—The prostate is slightly enlarged, the seat of a diffuse swelling, or enlarged in certain parts. The cut surface appears of a pale, dirty-brown color, softer and juicier than normal, and infiltrated with indurated bands of connective tissue of an ivory whiteness.

Microscopic Appearances.—The *prostatic tubules* are stretched and changed into smaller or larger cystic cavities. Their walls are thickened from infiltration with round cells and swelling of the epithelium.

The *prostatic ducts* and *their mouths* are dilated and the seat of a round-celled infiltration, which stiffens them and keeps them open and gaping. The mouths of the ducts may be filled with small plugs of secretion, which are forced out by muscular contraction on urination, and appear floating in the urine as tadpole or comma-shaped bodies, under the name of "*Fürbringer's hooklets.*"

In certain cases the mouths of the ducts are closed, so that the secretion does not run out.

The *cavities of the dilated tubules* are filled with a turbid, slimy fluid, composed of pus-cells, desquamated epithelium, and altered prostatic fluid; and gonococci are harbored at this point for an indefinite number of years. All the tubules of the gland may be more or less affected, or the changes may be limited to a few scattered groups of tubules in one or both lobes.

The *intertubular fibromuscular stroma* is infiltrated with broad, tough, ivory-white bands of connective tissue.

SYMPTOMS.

As chronic prostatitis is always complicated by chronic posterior urethritis, the symptoms will arise from both conditions, and are as follows:—

(*a*) Frequent and urgent urination.

(*b*) Partial or complete impotence.

(*c*) Mental symptoms which are grouped under the general term "sexual neurasthenia."

The mental symptoms may be absent, but are usually very striking in effect upon the spirits and temper. The patient becomes profoundly melancholic and loses all mental and bodily strength. He suffers from hypochondria, irritability of temper, depression of spirits, inability for prolonged mental effort, forgetfulness, etc.

The only symptom which points directly to the involvement of the follicles of the prostate is

(*d*) **Prostatorrhœa,** which is the term given to the discharge, from the meatus, of a turbid, thick, sticky fluid of a brownish-yellow color, which generally occurs intermittently.

It is most frequent after stool and is then termed *defecation prostatorrhœa;* and occurs more seldom at the end of urination, when it is spoken of *micturition prostatorrhœa.*

The discharge is accompanied by an unpleasant sensation in the deep urethra, and is followed by a feeling of weakness and exhaustion.

Prostatorrhœa is due to the contractions of the muscles about the base of the bladder and rectum, pressing upon the prostate and squeezing out the contents of the prostatic tubules through their dilated and stiffened ducts.

Prostatorrhœa never occurs normally, and is important to differentiate from *other* urethral discharges.

The easiest of these to recognize is *"urethrorrhœa ex libidine."* This is the clear, transparent albuminous fluid, emitted from every healthy urethra on sexual excitement and erection. The secretion is not derived from the prostate, but from Littré's glands and Morgagni's crypts in the urethra.

The discharge in *chronic gonorrhœa* is purulent in appearance and contains numerous pus-cells, epithelium, gonococci, and other micro-organisms.

True *spermatorrhœa* and *seminal emissions,* either sleeping or waking, are characterized by the presence of spermatozoa, while in prostatorrhœa spermatozoa are absent.

COMPLICATIONS.

Smaller or larger abscesses may form in the diseased gland and communicate with the urethra. After they have discharged the pus, their cavities fill with urine at each act of urination, and slowly and incompletely void their contents.

The patient suffers all the inconveniences of partial urinary incontinence, and the stinking pus from the cavity flows out incessantly and involuntarily from the urethra.

The prostate may subsequently become changed into a large cavity in which sounds and catheters are apt to catch.

Another danger which threatens a patient with chronic prostatitis is *tuberculosis* of the genital organs.

Its development is favored by the factors which tend to lower the local resisting power.

These consequences only occur in neglected cases which have continued for a long time.

DIAGNOSIS.

As the clinical history of chronic prostatitis, seminal vesiculitis, and chronic posterior urethritis is similar, we can only make a differential diagnosis by a careful examination of the patient.

The most important diagnostic measures consist in:—

I. Palpating the prostate per rectum.

II. The microscopic examination of the fluid which has been expressed from the prostate by digital pressure.

On **palpation of the prostate,** the whole organ may be found enlarged and tender, or the right or left lateral lobe may be involved alone. If a few scattered tubules are affected, shotlike nodulations will be noticed, distributed irregularly over the surface. In the later stages, with the formation of fibrous tissue in the intertubular substance, the prostate is only slightly enlarged, but *hard.*

To distinguish between prostatitis and seminal vesiculitis is at times difficult, even for one with experience.

The seminal vesicles are often involved at the same time, and the entire mass, made up of enlarged prostate and swollen vesicles, imbedded in a mass of infiltrate, may be easily mistaken for an uncomplicated prostatitis.

If no perivesicular infiltration is present, the *sharp outline of the upper margin of the prostate* can easily be felt.

If perivesiculitis has occurred and the lower part of the vesicles is embedded in an inflammatory exudate, the *upper margin of the prostate cannot be felt,* and the examining finger glides over the upper border and along the posterior surface of the vesicles without perceiving the furrow indicating the line of demarcation between the prostate and vesicles.

On palpation of the prostate, it is found that the secretion is more easily expressed than in the normal condition, and in this way we can obtain the material for the **microscopic examination of the prostatic fluid.**

This is obtained by what is termed the **expression-urine test,** which is made by massaging the prostate through the rectum and so expressing or forcing out the contents of the prostatic tubules through their ducts into the urethra. The patient then urinates into a glass and the stream of urine washes out the expressed prostatic contents into the glass.

On inspection, after massaging a normal prostate, the urine is seen to be milky, from admixture with prostatic fluid.

If the prostate is diseased, flakes, chunks, and masses, formed of caked and thickened prostatic secretion, are generally noted, but sometimes the expression-urine only appears turbid from mixture with pus. Fürbringer's hooks from the prostatic glands are often present.

By inspection alone we cannot form a correct opinion, and it is essential to submit the centrifugated sediment from the expression-urine to microscopic examination.

In order to save time the expressed prostatic secretion may also be collected at once on a glass slide and examined with the microscope.

MICROSCOPIC EXAMINATION.

If the prostate is the seat of acute or chronic inflammation, the microscope shows PUS-CELLS in greater or less numbers, and often gonococci. If no pus is present, prostatitis can be excluded.

The normal prostatic fluid is found to contain many elements on microscopic examination. The findings are:—

I. *Mucus and granular phosphates,* with certain crystals, either *oxalate of lime, triple phosphates,* or *crystalline calcium phosphate.* If the urine is received immediately after being passed, the granular phosphates may be in the form of casts or clumps, but if it has stood for some time these break up and the phosphates are scattered throughout the urine.

II. *Epithelium* from the bladder, glands, and ducts of the prostate.

III. *Amyloid Bodies.*—Authorities differ as to the frequency with which these are seen. They are generally absent in young and middle-aged subjects, but occur more frequently in elderly men. When present they are seen to have a concentric arrangement and are formed from the secretion of the prostatic cells and broken-down cells. Later they may become calcified and form prostatic concretions.

IV. *Phosphatic concretions* are occasionally found, and in older subjects large hyaline cylinders, which are due to the inflammatory exudation which takes place in the gland tubules.

Many of the above findings are also present in seminal vesiculitis, but one element is absolutely characteristic of the prostatic secretion, as it is found nowhere else, and that is

V. *Boettscher's Crystals.*—These crystals are formed by adding a drop of 1-per-cent. ammonium phosphate solution to the secretion expressed from the prostate.

The crystals are distinguished by their dagger shape and the beautiful forms which they assume upon crystallization, and their base is found nowhere but in the prostatic fluid. In order to find them it is necessary to examine the prostatic secretion without mixture with urine, as the urine interferes with the crystallization.

The unmixed prostatic fluid can be obtained by collecting on a cover-glass some of the fluid which escapes from the meatus after massage of the prostate.

VI. *Spermatozoa.*—These are not found in cases of uncomplicated chronic prostatitis, but as it is almost impossible to massage the prostate without at the same time expressing some of the contents of the vesicles, spermatozoa are generally found.

VII. *Lecithin droplets,* which appear as round refractile bodies and are chemically a glycero-phosphate of neurin.

VIII. If the prostate is the seat of acute or chronic inflammation, *pus-cells* are always found, and from a clinical standpoint the pus-cells are the important elements to look for, as, if no pus is present, prostatitis is at once excluded.

In considering the question of marriage for an individual who has had prostatitis, the permission should not be given *if pus is present,* even though no gonococci may be found.

For while gonococci are easily found in the expressed pus when abundant, a few may still exist in the prostatic tubes, with all their infectious qualities, which may be overlooked on microscopic examination.

On examining a case of chronic prostatitis with **the endoscope,**

P. S. BRUGUIERE, M. D.

a chronic inflammation of the posterior urethra is found to be nearly always present.

The mucous membrane of the posterior urethra is purplish-red, swollen, and congested. The verumontanum is greatly enlarged, so that it stands up at the end of the endoscopic tube like a half-ball and bleeds freely.

PROGNOSIS.

The prognosis of chronic prostatitis is, on the whole, not unfavorable, but improvement is slow, and treatment must be continued for a long time. Improvement can be readily noted by feeling the decrease in size of the prostate through the rectum, and after a short time under treatment the mental symptoms of the patient undergo a marked change for the better.

Relapses are apt to occur, from a lighting up of the catarrhal inflammation, and must be treated by suspending all local treatment with sounds, and relying on irrigations or instillations of nitrate of silver into the posterior urethra.

In regard to the *infectiousness* of chronic prostatitis, von Notthaft[1] examined 120 cases, and found gonococci present in the secretion in 73 per cent. of cases during the second half-year after infection.

This number diminished in the third half-year to 50 per cent., in the fourth half-year to 18 per cent., and in the third year to 6 per cent.

From the end of the third year, gonococci disappeared from the secretion.

Other bacteria appeared after a few months, occasioning a mixed infection, which persisted after the disappearance of the gonococci.

TREATMENT.

It is important, in the treatment of these cases, to secure the confidence of the patient and encourage him by explaining that his condition is one which can be cured, and that he is not impotent nor likely to become so, and that the mental disturbances of which he complains are due to a purely local condition which is not dangerous.

The first indication for treatment is to improve the general condition of the patient by means of diet and exercise in the open air.

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[1] Archiv f. Dermatologie und Syph., Bd. lxx., Hft. 2.

Constipation is generally a prominent symptom, and it is necessary to regulate the bowels, using saline cathartics for their depleting action on the pelvic organs, which has some effect in relieving the congestion of the prostate.

Ergotin in doses of 15 minims, three times a day, is recommended by some authorities.

Of course, all sources of erotic excitement should be interdicted on account of their effect in inducing congestion of the prostate. Under the head of *local treatment* we can speak of measures which have a more direct action upon the prostate itself.

Sitz-baths of hot salt-water of from ten to fifteen minutes' duration have an effect in improving the condition of the diseased organ. Irrigation of the rectum with a Kemp tube, with either hot or cold water, is often beneficial, and in patients with marked neurasthenia the alternate flow of a hot-and-cold irrigation through the rectum is useful. The alternate flow can be arranged by filling two douche bags, one with hot and the other with cold water, and attaching first one and then the other to the rectal tube. (Wossidlo.)

The most useful means of affecting the prostate itself is **massage through the rectum**, and we can in this way express the contents of the tubular glands.

The advantage comes from periodically emptying the dilated prostatic tubules of their retained and thickened secretion. There is also an improvement in the blood-circulation, which causes absorption of the inflammatory products and strengthens the relaxed muscular fibers.[1]

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[1] The author has often noted that in certain cases, on beginning the treatment by massage, there would be no immediate improvement.

After massaging a number of times the prostrate, which was originally *hard*, begins to feel soft, and at each massage a larger amount of pus was expressed than on beginning treatment.

When softening and increased discharge once begin; the enlargement of the prostate disappears with great rapidity, sometimes in one week.

The probable explanation is that the ducts of the dilated tubules are closed, and that the massage forces out the plug and also presses out the accumulation of pus in the dilated tubule, and the prostate collapses after being emptied

In other cases a drachm of prostatic fluid mixed with pus may be expressed at the first massage, and the quantity diminishes at subsequent sittings till only a few drops are squeezed out.

These patients often require only a few applications of the massage before they are entirely cured.

The massage should be performed every second, third, or fourth day, depending upon the patient's tolerance.

After every massage of the prostate, a copious urethro-vesical irrigation should be made, using albargin 1 in 1000 if gonococci are present, oxycyanat of mercury 1 in 4000, or nitrate of silver 1 in 10,000 to 1 in 4000, if there are no gonococci.

Frank advises using an irrigation before massage and another afterwards, as in this way he believes that organisms which might enter the ejaculatory ducts during the massage and cause epididymitis, are destroyed. Since adopting this practice he notices that epididymitis occurs less frequently as a complication during the treatment than before.

It is important at the same time not to overlook the POSTERIOR URETHRITIS, but to cure that as well.

If there is a great deal of catarrhal inflammation, with much pus-formation, irrigations are in order; but, if the suppuration is only slight, *instillations* with an Ultzmann syringe are indicated.

In light cases 5 or 10 grains to the ounce of nitrate of silver may be used, but in old and obstinate cases stronger solutions are called for, and the strength may be gradually increased to 25 grains to the ounce.

Strong solutions can be better applied through the **endoscope.**

In nearly every case of chronic prostatitis the verumontanum is markedly diseased and requires particular attention.

The best method of treating it is to apply a strong solution of nitrate of silver, 100 grains to the ounce, directly upon it through the urethroscope.

Some reaction follows these applications, the discharge increases, and the patient has frequent urination, often followed by bleeding.

After eight or ten days it is safe to make another application.

Trichlor acetic acid, 5 per cent., or pure carbolic acid may be used if the nitrate of silver causes too much pain.

After half a dozen strong applications, the verumontanum will be found to be in the normal condition again; but if the chronic posterior urethritis accompanying the prostatitis has existed long, a submucous infiltration will have occurred, which also demands treatment by **dilatations with the Kollmann-Frank irrigating posterior dilator.**

The indication for beginning dilatations, as stated by Frank, is after the massage has been continued for some time and the prostate feels normal, but the patient still has symptoms of neurasthenia, and the microscope shows a small amount of pus in the expressed prostatic secretion.

The *Benique sound* is sometimes used as a means of dilating the posterior urethra, since from its shape and weight it exercises a certain amount of compression, which is a stimulant to the process of absorption, but it is not as useful as the posterior dilator.

After the local conditions in the prostate and posterior urethra have been cured, the neurasthenia generally disappears. When, however, it persists, *faradism*, with one pole in the urethra and the other in the rectum, is often beneficial. (See Posterior Urethritis.)

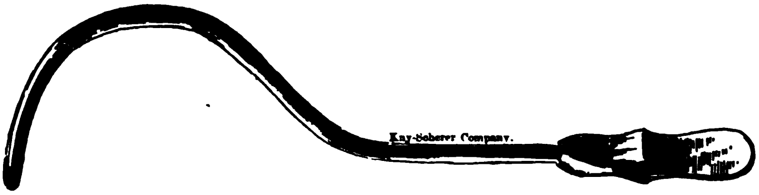

Fig. 47.—Benique Sound.

In a few cases, after massaging the prostate for eight or ten weeks, pus is still present in the expressed secretion.

In such instances it is desirable to stop the treatment and give the patient a complete rest.

After a couple of months without treatment it is not uncommon to find that complete healing has occurred and the pus has entirely disappeared.

If no improvement has taken place, it is proper to begin massaging again, and after another three months' treatment, if the patient is not well, the case may be regarded as incurable. (Wossidlo.)

DISEASES OF THE SEMINAL VESICLES.

CHAPTER VIII.

ACUTE SEMINAL VESICULITIS.

Acute inflammations of the seminal vesicles are generally due to gonorrhœa, although a chronic inflammation may originate from other causes.

A gonorrhœal inflammation of the interior of the cavity of the vesicle is excited when the gonococci pass from the posterior urethra through the ejaculatory ducts, and are deposited within the vesicle.

Its walls secrete pus and its cavity soon becomes filled up and distended with a purulent accumulation.

SYMPTOMS.

The symptoms are not very characteristic, and are merely those of the posterior urethritis, which, of course, is always present. Fever and a throbbing pain in the vesicles and tenderness in the suprapubic region are always observed.

Seminal discharges which are *red* or *chocolate colored* from the admixture with blood often occur. The blood may be derived from the cavity of the vesicle itself or may be acquired by the semen, from a congested posterior urethra, as it passes through it.

If the posterior urethritis is cured, the urine is clear at first, but later in the disease the vesicles pour out their purulent contents into the posterior urethra, and the pus flows back into the bladder, discoloring the urine when it is passed.

DIAGNOSIS.

The diagnosis of seminal vesiculitis can only be made by *rectal examination*, and the vesicles can be felt swollen, soft, fluctuating, and intensely tender.

Epididymitis is a most frequent result of vesiculitis, and is brought about by some of the gonococci-laden pus-cells being carried through the vas deferens and deposited in the epididymis.

Peritonitis, which sometimes becomes general, may occur from the close relation which the peritoneum bears to the vesicles.

TREATMENT.

The treatment of acute vesiculitis is chiefly expectant, and consists in putting the patient to bed and giving a saline cathartic, which is always in order in every pelvic inflammation.

Hot sitz-baths and copious irrigations of the rectum with hot water are useful in allaying the inflammation.

If the posterior urethritis is severe, sandal-wood oil relieves the tenesmus and renders the urine less irritating.

Injections into the anterior urethra, of course, are contra-indicated, but above all things any attempt at massage or stripping the vesicles should be absolutely interdicted.

Under this plan of treatment most cases of acute vesiculitis will get well in from two to four weeks' time; but when resolution does not occur the disease passes into the chronic state.

CHRONIC SEMINAL VESICULITIS.

The condition of chronic inflammation of the seminal vesicles was but little understood until the publication of Eugene Fuller's first paper upon this subject in 1893. Chronic vesiculitis may originate from an *acute* attack of vesiculitis which does not undergo resolution; but, as a rule, it develops insidiously, as the result of the extension of a chronic inflammatory process which begins in the posterior urethra and extends through the ejaculatory duct. The ejaculatory duct is never compressed by the changes, but throughout the whole course of the disease it remains patulous, and sterility does not occur.

According to the classification devised by Fuller, chronic seminal vesiculitis presents itself in *two varieties*:—

I. **Atonic vesiculitis,** in which there is only an atony of the muscular fibers composing the walls of the vesicle.

II. **Inflammatory vesiculitis,** in which the walls of the vesicles are thickened and indurated as a result of inflammation, which may be simple, gonorrhœal, or tubercular in origin.

Either form of vesiculitis may exist by itself; but, as a rule, there is a combination of atony and inflammation of the vesicular walls.

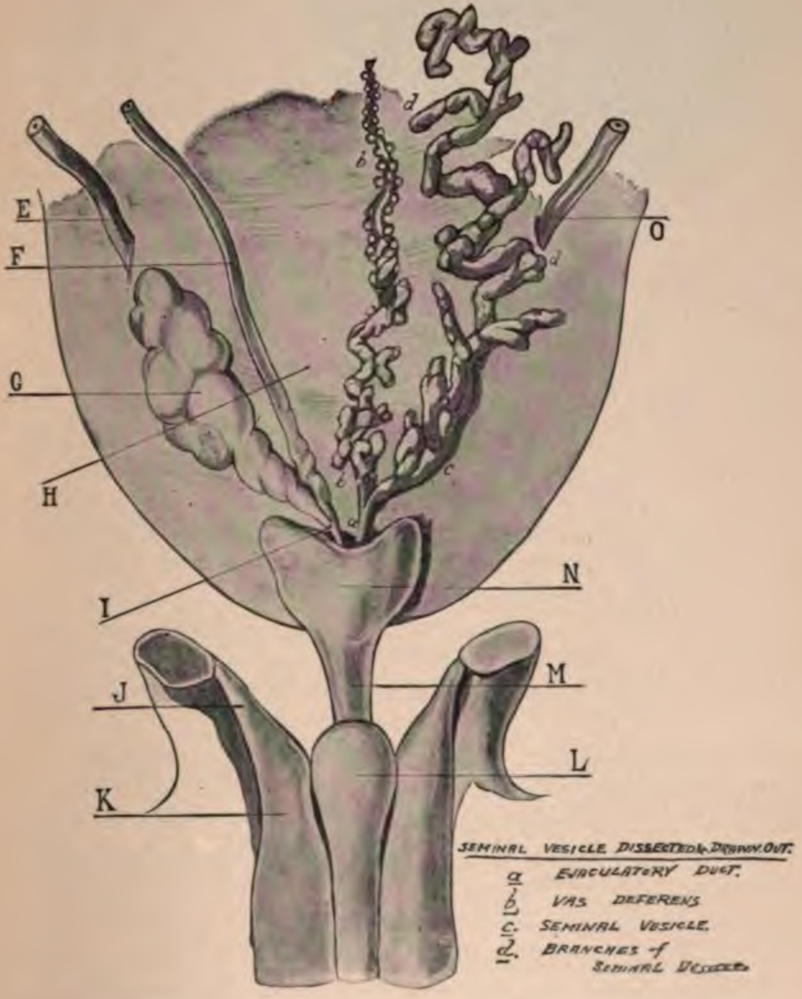
E
F
G
H
I
J
K
L
M
N
O
a
b
c
d
SEMINAL VESICLE DISSECTED & DRAWN OUT.
a EJACULATORY DUCT.
b VAS DEFERENS
c. SEMINAL VESICLE.
d. BRANCHES of SEMINAL VESICLE

Fig. 48.—Diagram of the Seminal Vesicles. The Right Vesicle has been dissected, and its Convolutions drawn out straight.

E, Ureter.
F, Vas Deferens.
G, Seminal Vesicle.
H, Base of Bladder.
I, Ejaculatory Duct.
J, Crus Penis.
K, Corpus Cavernosum.
L, Bulbous Urethra.
M, Membranous Urethra.
N, Prostate.
O, Ureter.

Atonic Vesiculitis.

This form of vesiculitis may be induced by a previous attack of acute inflammation in the organ, which does not undergo complete resolution. It is more liable, however, to be provoked by some form of sexual abuse, which consists in a frequent repetition of the sexual act. In consequence the muscular fibres become exhausted, lose their tone, and the walls of the vesicles become thinned, atonied, and stretched. The cavities become distended with seminal fluid, because the weakened muscular fibers are no longer able to evacuate the contents, and the secretion becomes thick and inspissated.

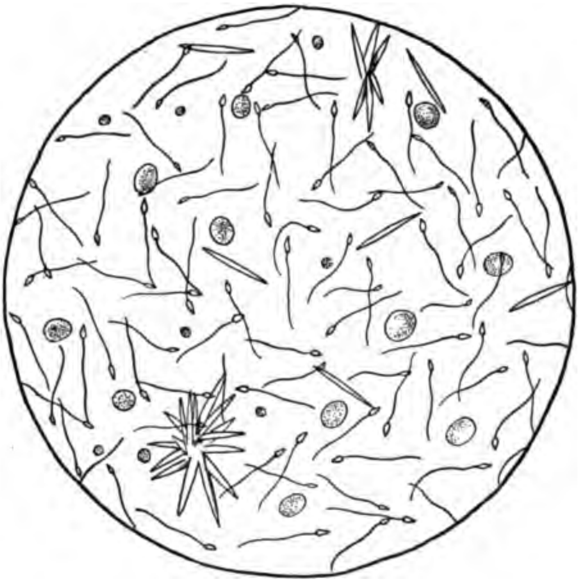

Fig. 49.—Microscopic examination of material expressed from seminal vesicles and prostate, showing Spermatozoa, Pus-cells, and Boettscher's Crystals.

The vesicles are distended and enlarged, and feel like a swollen leech to the examining finger.

On stripping the vesicles the expressed seminal fluid appears abnormal.

The *expression-urine* is not clear or slightly milky in color as it should be, but the expressed contents of the vesicles appear in the glass of urine as *coagulated masses* of *gelatinous material,* which often resemble casts half an inch long and as thick as a knitting-needle. These masses are the jellified contents of the vesicle, molded by the ejaculatory ducts, as they are squeezed through them.

The other form in which the inspissated semen is found resembles sago-like globules floating in the urine.

After a time the atonic vesicle almost invariably becomes infected by some germ, often the bacillus coli from the rectum, and inflammatory changes are induced.

For practical purposes it is only necessary to consider two forms of chronic inflammation of the vesicle:—

(a) Chronic inflammation without perivesiculitis.

(b) Chronic inflammation with perivesiculitis.

When *perivesiculitis is absent,* there is no inflammatory infiltration or hyperplasia of the connective tissue surrounding the vesicles. The vesicle is large, and its walls are thinned and atonied, but they are hardened and sclerosed by fibrous changes, as a result of the inflammation which always occurs in this form within the walls.

A muco-purulent secretion may be abundant and accumulate within the cavity of the vesicle. Granulations often form within the cavity, causing hæmorrhage.

The entire vesicle may be filled with a blood-clot, or, if the bleeding is slight, the seminal discharges may be stained brown or chocolate color.

When *perivesiculitis is present,* a small round-celled infiltration is thrown out in the early stages, surrounding and imbedding the vesicles. In time the infiltration becomes organized with fibrous connective tissue, which forms adhesions, binding the vesicles down to the base of the bladder. The entire mass, composed of vesicles imbedded in fibrous tissue, appears like a part of the prostate, and may easily be mistaken for it, on rectal examination.

After the fibrous tissue has existed for a little time, it begins to contract and in consequence the vesicles are pressed upon and squeezed together so that they become smaller than normal.

The ejaculatory duct is never compressed by these changes, but always remains open; consequently there is no sterility.

ETIOLOGY.

As to the etiology of the inflammatory forms of vesiculitis, gonorrhœal infection is a very frequent cause.

Chronic vesiculitis may originate from an *acute* attack of vesiculitis; but it is more frequently due to a *gonorrhœal* inflammation of the posterior urethra, which extends along the ejaculatory duct and attacks the walls of the vesicle and often the perivesicular connective tissue.

Other causes besides gonorrhœa may induce chronic inflammatory changes in and around the vesical walls.

A *non-specific vesiculitis,* so called to distinguish it from the gonorrhœal, or specific, form, may arise *within* the cavity of the vesicle itself, as a result of an atonic condition of the vesicle.

Again, a low grade of chronic inflammation of the posterior urethra may be established as a result of sexual excesses, masturbation, etc., which spreads along the ejaculatory duct and attacks the vesical wall.

Finally, with old men who are beginning catheter life the traumatism often excites a subacute inflammation of the vesicles, which extends to the epididymis.

SYMPTOMS.

The symptoms of both gonorrhœal and simple vesiculitis depend chiefly upon the accompanying posterior urethritis, and consist in frequent urination and spasm or irritability of the cut-off muscle. On straining at stool a glairy, sticky discharge escapes from the meatus, which is the secretion expressed from the dilated and patulous ejaculatory ducts and is termed *spermatorrhœa.*

The *mental symptoms* are always very prominent, and the individual suffers from depression of spirits and melancholy, irritability of temper, and quarrelsomeness. Hypochrondria is notably marked, and patients are alarmed over ridiculous trifles. They complain of the penis being shriveled, cold, or numb; that the testicles are retracted or that one hangs lower than the other; and suppose that the testicles are beginning to atrophy and they are growing impotent. In their alarm they consult some of the advertising quacks, who prey upon their fears and deluded ignorance.

Another important group of symptoms is connected with the *sexual function.* In the early stages there is an increase in the sexual desire, with frequent nocturnal emissions and premature ejaculation on coitus. The seminal discharges are often mixed with blood, which may be acquired from the posterior urethra or the cavity of the

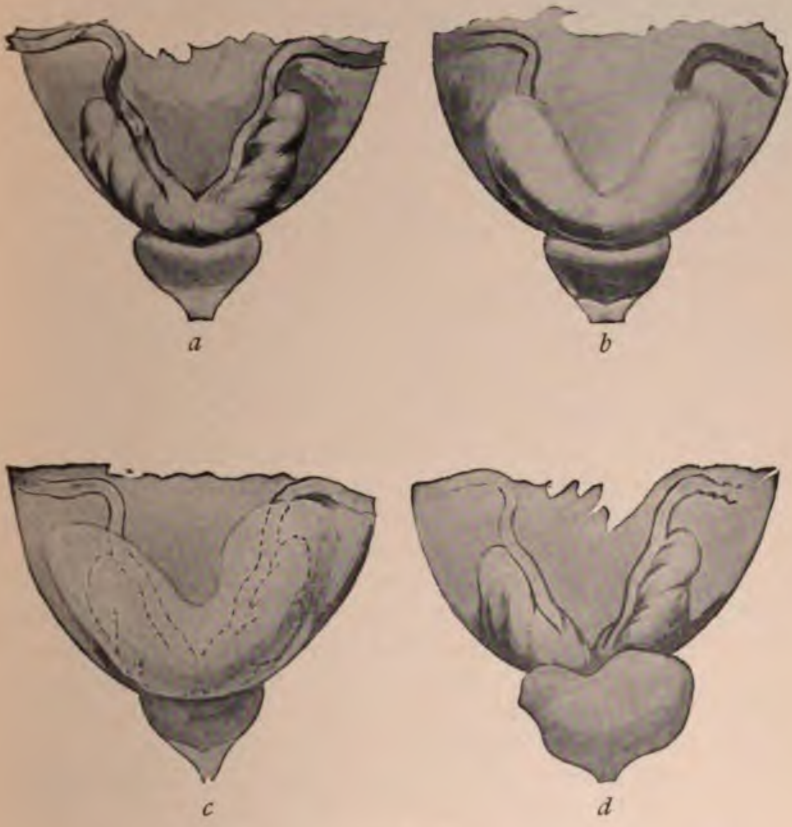

Fig. 50.

a. Normal seminal vesicles and prostate.

b. Chronic seminal vesiculitis without perivascular infiltration—no involvement of prostate.

c. Chronic seminal vesiculitis with perivascular infiltration. Outline of vesicles indicated by dotted lines. White area surrounding them composed of infiltration. Prostate not affected.

d. Prostate irregularly enlarged from chronic prostatitis. No involvement of vesicles.

vesicles. As the case progresses, erections cease, the sexual desire is lost, and at last a condition of true impotence is established.

DIAGNOSIS.

The clinical history of these cases is generally significant of involvement of the vesicles, in the gonorrhœal form. The patient complains of a gonorrhœal discharge, which lasts, with intermissions, for years. Any slight indiscretion brings on an exacerbation, which is often mistaken for a fresh attack of gonorrhœa. The discharge lasts for a few days and then subsides, until another indiscretion lights it up again.

The diagnosis can only be made by **rectal examination,** and in order to determine the condition of the vesicles a very considerable amount of practice is necessary in order to attain the necessary *tactus eruditus.* As the vesicles and prostate are continuous, without a line of demarcation, when the perivesiculitis is present, it is difficult for the beginner to differentiate them, and, until one is experienced, a diagnosis of enlargement of the prostate is generally made, when the vesicles alone are enlarged and the prostate is normal in size.

Technique of Examination.—The patient, with his bladder moderately distended with urine, assumes the "leap-frog" attitude, bending over a chair and grasping the sides with his hands. The surgeon makes counter-pressure with one fist doubled up, pressing against the bladder, and the index finger of the other hand is inserted into the rectum. In order to get well up beyond the upper margin of the vesicle, it is necessary for the surgeon to support his right foot on a chair and by means of his knee make strong pressure against the elbow of his examining hand, in order to drive it well in.

If the vesicles are normal, they feel soft, and the amount of distension depends on circumstances. If *atonic vesiculitis* is present, they feel large, distended, tense, and very painful. If *perivesiculitis* exists, they are hard, indurated, and brawny, feeling like a piece of pork, on account of the infiltration through the connective tissue, which surrounds the vesicles and forms adhesions which bind them down upon the bladder.

After examining the condition of the vesicles their contents should be stripped or expressed by the examining finger, beginning at the upper margin and squeezing or stroking in a downward direction, so as to press out the contents through the ejaculatory duct. The quantity of expressed material which runs out at the meatus varies from a few drops to half a drachm or more. On examination the material is found to be thick and jellied or purulent.

The fluid expressed should be always examined microscopically. On examination with the microscope, *normal semen*, which is a mixed secretion from the prostate and vesicles, is found to be composed of large and small finely granular testicle-cells, some columnar and squamous epithelium, a few large, round hyaline bodies, lecithin corpuscles, amyloid bodies, a few leucocytes, spermatic crystals, and spermatozoa. In chronic seminal vesiculitis, *pus* is added to these findings and the spermatozoa are entirely absent or diminished in number, and either dead or of a very slight degree of motility.

As the patient's condition improves the spermatozoa reappear and also regain life and motility.

TREATMENT.

The treatment consists in stripping or expressing the contents of the vesicles once in from five to seven days. The effects of stripping are to empty the vesicles of their inspissated contents, without forcing the muscular fibres to contract, and eject the semen, and through the rest thus afforded them the muscles recover their tone. The inflammatory thickening around the vesicle is absorbed as a result of the massage.

Contraindications to stripping are (*a*) the existence of an acute attack of vesiculitis, (*b*) blood in the expressed material, (*c*) or excessive tenderness. With these conditions present there is always danger of setting up an epididymitis.

The posterior urethra should not be overlooked, but should receive appropriate treatment, with irrigations or instillations or by the endoscope. It is desirable, however, not to use local treatment to the posterior urethra and strip the vesicles at the same sitting, but to allow a couple of days to intervene. The duration of treatment is protracted, requiring from two to twelve months to effect a cure; but since Fuller's work upon the subject it is possible to cure cases which were beyond the reach of treatment before.

Seminal vesiclotomy has recently been practiced by Fuller in 21 cases.[1] The patient is placed in the knee-chest position and a free lateral incision is made in the perineum, which allows the rectum to be dislocated upwards, thus exposing the seminal vesicles and prostate.

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[1] Medical News, March 26, 1904; Journal of the American Medical Association, May 4, 1901.

After the vesicles have been brought into view, if thickened and distended, they may be opened by a free longitudinal incision and their cavities gently curetted.

Wherever the sacs are found bound down by perivesicular infiltration, the adhesions can be broken up and the vesicles left free, and when necessary the entire vesicle can be extirpated.

The cavity of the vesicle is drained with gauze and the wound partially closed by suture.

Fuller believes this method will prove of much value in very aggravated cases which are not relieved by protracted and systematic massage.

TUBERCULOUS VESICULITIS.

The seminal vesicles are usually involved by an infiltration with tuberculous nodules during the progress of a case of genito-urinary tuberculosis.

The infection may extend from tuberculous deposits in the posterior urethra or prostate or may result in consequence of an extension of the disease from the epididymis along the vas deferens.

It is supposed that the involvement of the vesicles in the majority of cases is *secondary*, although J. W. White has noted that the vesicles often show evidences of infection weeks or months before the tuberculous process is evident in the corresponding epididymis.

A chronic or subacute inflammation of the vesicle, either gonorrhœal or simple, is a strong predisposing element in allowing the tubercular process to become ingrafted upon these organs.

Uncomplicated tuberculous disease of the vesicles is never acute except in the presence of a mixed infection, either with the gonococcus or staphylococcus.

In this case an acute suppurative inflammation takes place within the cavity of the vesicle, which becomes filled and distended with pus.

Uncomplicated tuberculosis begins insidiously, and has a notable tendency to invade the surrounding tissues, and the process often becomes quiescent, although liable to take on renewed activity upon slight provocation.

A few cases, however, result in breaking down of the tuberculous nodules, with the formation of a perivesicular abscess, which discharges either through the rectum or perineum, leaving a fistula.

The symptoms of tuberculosis of the vesicle are not marked, and this condition exists unsuspected until a rectal examination is made, disclosing hard nodules in the walls and perivesicular connective tissue.

As both vesicles are infiltrated and thickened as well as the connective tissue around them, the mass is continuous with the prostate, and it is no easy task to distinguish these structures apart. In advanced cases the prostate is almost always the seat of tuberculous deposits as well.

TREATMENT.

The treatment consists in hygienic measures alone, of which the most important is an outdoor life in a suitable climate. Cod-liver oil and creasote are the drugs most in vogue.

Operative treatment is, in general, not required in acute suppurative inflammation caused by a mixed infection, when the accumulation of pus takes place *within* the cavity of the vesicle, as the pus drains out into the urethra, through the ejaculatory duct.

When, however, the *perivesicular* tissue infiltrated with tubercular nodules breaks down and forms an abscess, it is necessary to evacuate the pus. This may be accomplished through a free incision in the perineum, or, as Fuller and Routier prefer, by thrusting a director into the tumefaction, through the rectum, and divulsing the tissues until an opening large enough to admit the finger is obtained.

Extirpation of the vesicle has been attempted a few times for tuberculosis, but the results are far from satisfactory.

From the inaccessible location of the vesicles, an extensive incision is required to reach them, and the hæmorrhage is difficult to control.

The bladder-walls and prostate are generally affected, and it is difficult or impossible to remove all the diseased material. The wound is slow in healing, and the confinement to bed exerts a bad influence upon the general condition of the patient: so that the tuberculous deposits, which are usually present elsewhere, advance in consequence.

STRICTURE OF THE URETHRA.

CHAPTER IX.

SPASMODIC STRICTURE.

Spasmodic stricture is a pure functional disturbance, without organic change, consisting in a spasm or cramp-like contraction of the cut-off muscle surrounding the membranous urethra.

CAUSES.

(*a*) *Located in the posterior urethra.* An abnormal irritability from excess in coitus or masturbation.

(*b*) *Located in the anterior urethra.* A granular patch or stricture. The introduction of a foreign body, such as a sound or bulbous bougie, or a piece of calculus, formed in the bladder and making its way through the urethra, and finally the reflex irritation caused by a narrow meatus.

(*c*) *Point of irritation not in the urethra, but remote from it,* as an operation about the anus, fissures or fistula of the anus, and entozoa in the rectum.

(*d*) *Various psychical influences,* such as shame or embarrassment.

The influence of these various points of irritation is carried through the nervous system and causes, as a reflex, a contraction of the cut-off muscle.

ORGANIC STRICTURE.

DEFINITION.

A deposit of newly-formed fibrous connective tissues lying underneath the mucous membrane of the urethra and interfering with its dilatability. This fibrous tissue has a tendency to contract and produce a narrowing of the urethral calibre.

ETIOLOGY.

(*a*) ***Inflammation,*** which is generally due to gonorrhœa, occasions an infiltration of small round cells which, if not absorbed, becomes organized into connective tissue.

(*b*) *Traumatism.*—A laceration or rupture of the urethra is healed by the process of cellular infiltration, which is thrown out to a considerable extent and subsequently becomes organized into connective tissue. Traumatic strictures are always notably dense and tough.

PATHOLOGY.

In gonorrhœa, particularly the chronic form, the mucous membrane of the urethra becomes the seat of an infiltration with small round cells, which extends into the submucous connective tissue and finally involves the spongy tissue of the corpus cavernosum.

If the infiltration is *absorbed,* stricture does not form; but if absorption does not take place the infiltrating small round cells become transformed into ***spindle cells,*** and these are ultimately converted into dense, retracting connective tissue (scar-tissue). The transformation goes on slowly, and it requires at least one or two years before the soft infiltration has become organized.

The following changes in the tissues result from the contraction of the new fibrous tissue:—

The crypts and follicles of the urethra, which were surrounded by the periglandular infiltration, have been obliterated by the contraction of the fibrous tissue.

If the corpus spongiosum was involved, its meshes are obliterated in the same way.

The calibre of the urethra is narrowed by the presence of a mass of firm, bloodless scar-tissue, composed of fibrillated connective-tissue cells lying underneath the mucous membrane and covered with many layers of squamous epithelial cells.

Desquamation of these squamous epithelial cells continues for years, forming light filaments, which float in the urine.

VARIETIES OF ORGANIC STRICTURE.

I. **Soft or recent stricture** is merely an infiltration of the tissues with inflammatory products, composed chiefly of small round cells.

II. **Cicatricial or inodular stricture** is a mass of new fibrous tissue which has been formed by the transformation of the soft infiltration into true contractile connective tissue, and which, as it becomes older, grows tougher, denser, and more inelastic.

A stricture is described as *linear* when it consists of a fine band of fibres, *annular* when it is composed of a broader band encircling the urethra, and *tortuous* when it is made up of a heavy, irregular mass of tissue, producing a great deal of distortion and narrowing of the urethral canal.

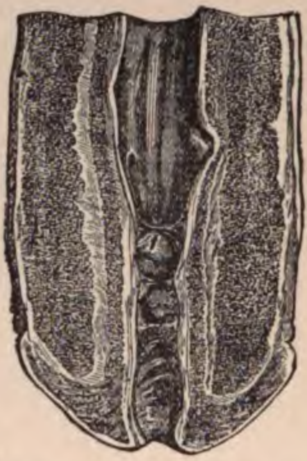

Fig. 51.—Linear Stricture.

NUMBER.

Traumatic stricture is always *single,* and occurs at the point of rupture in the canal.

Gonorrhœal strictures are apt to be *multiple,* and it is usual to have two or even three present at the same time.

LOCATION.

Sir Henry Thompson examined 320 anatomical preparations of stricture and found that in 215 cases the bulbo-membranous region was strictured and in 105 cases the stricture was in the first five inches of the canal.

The prostatic urethra is *never* strictured except as a result of traumatism, as inflammation here only produces a simple condensation and hardening of the submucous tissues, but does not narrow the calibre of the canal.

CHANGES WHICH TAKE PLACE BEHIND THE STRICTURE.

As a result of the obstruction to the free outflow of the urine, the urethra becomes enlarged and pouch-like, and a loss of its elasticity follows, from the frequent stretching which accompanies each act of urination.

This pouch retains a drop or two of urine, which decomposes, irritates the mucous membrane, and causes a chronic inflammation, with a gleety discharge.

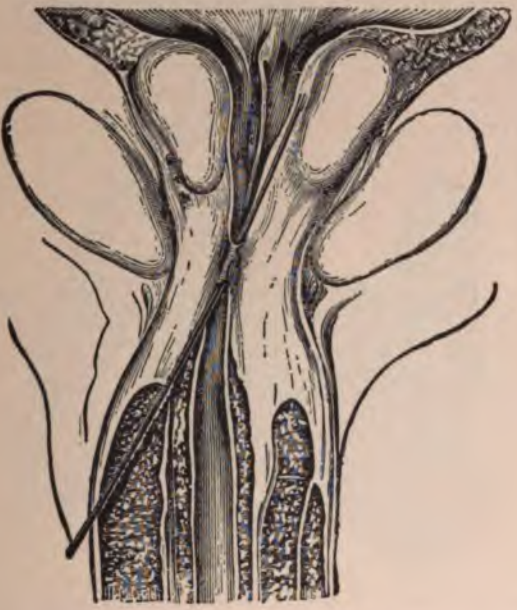

Fig. 52.—Annular Stricture.

The softened mucous membrane sometimes **ulcerates.** When a *small* ulceration occurs, a few drops of urine escape into the tissues and occasion a small abscess, which opens externally, forming a **urethral fistula,** or the urine may gain access to the tissues through the crypts and follicles which become dilated.

If a *large* ulceration takes place, a considerable quantity of urine

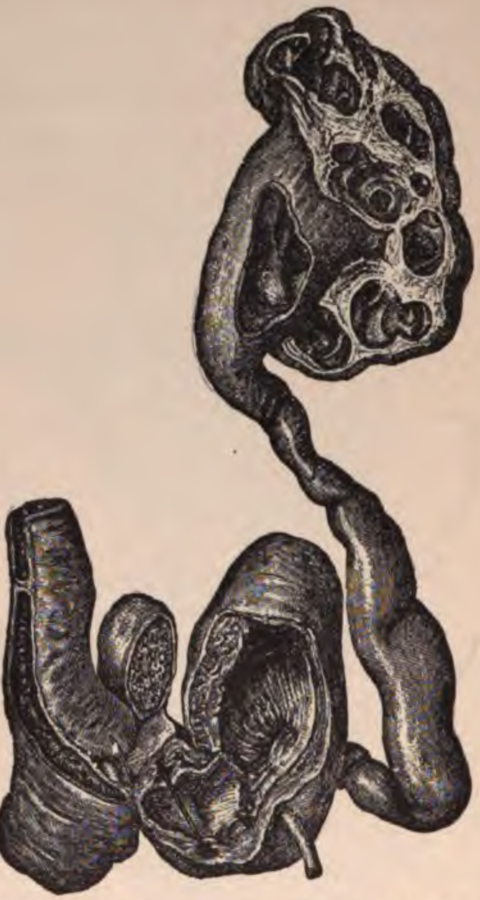

Fig. 53.—Changes behind a stricture. Dilatation of pouch immediately behind stricture. Hypertrophy and contraction of bladder. Dilatation of ureter and kidney (Hydronephrosis).

escapes into the loose cellular tissue, and **extravasation** of **urine** results.

CHANGES IN BLADDER AND KIDNEYS.

The increased effort on the part of the bladder to overcome the resistance offered by the stricture causes a **hypertrophy of the bladder-wall.** The muscular bundles project into the cavity of the bladder and diminish its capacity, and contraction of the cavity occurs.

In exceptional cases the walls become thinned and atrophied, and *vesical atony* results.

RESIDUAL URINE.

Definition.—*The urine which remains in the bladder after the patient has endeavored to evacuate it completely.*

Residual urine exists in 93 per cent. of cases of stricture, and increases as the age of the patient advances. It results in cystitis, with vesical atony and damming back of the urine upon the kidneys.

The **ureters** and **kidneys** become distended and dilated from the backward pressure of the urine, as a result of the muscular contractions of the bladder during urination.

The medullary tissue of the kidneys is atrophied, and sac-like dilatations form (hydronephrosis). Pyelitis and abscess of the kidney occur as a result of infection with bacteria conveyed upward from the decomposing residual urine.

SYMPTOMS.

(a) Frequent urination, in the early stages depending upon a congestion of the posterior urethra and exaggerated irritability. Later in the course of the case, cystitis causes the desire to urinate frequently, and after the bladder has become atonied and full of residual urine the dribbling and incontinence, or overdistension, take place.

(b) Dribbling after urination results from some drops of urine, which are caught in the pouch behind the stricture, escaping a few minutes later.

(c) Distorted or Smaller Stream.—The patient requires a longer time to pass his water, and the stream is twisted or split.

(d) Gleety discharge from the meatus, composed of muco-pus and shreds in the urine, is occasioned by the catarrhal inflammation of the mucous membrane *behind* the stricture, from the irritation of the decomposing urine.

(e) Retention of urine occurs at times suddenly and early from acute congestion of the mucous membrane at the strictured point, and is apt to be excited by exposure to cold or wet and alcoholic or sexual excesses.

Later in the progress of the case the retention is caused by the direct obstruction of the outflow of urine, arising from the slowly contracting stricture.

(f) Pain in the urethra is neuralgic in character and inconstant, and may never be felt.

(g) Interference with Coitus.—The erections are generally feeble, and premature ejaculation occurs from congestion and irritability of the posterior urethra, or the semen may be retained behind the stricture until the engorgement of erection subsides, when it oozes from the meatus.

DIAGNOSIS.

The examination of the urethra, as a rule, is not very painful, but in nervous individuals it may be injected with a 4-per-cent. solution of cocaine.

For purposes of diagnosis the **steel sound** is too inexact, since, without disclosing any details, it will merely demonstrate that an obstruction exists in the urethra which prevents the sound from entering the bladder.

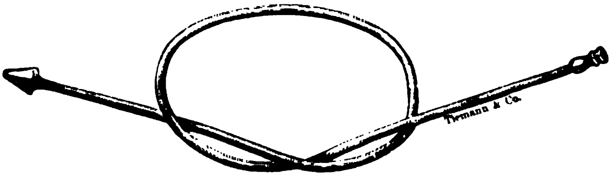

Fig. 54.—Flexible Bougie à Boule.

By means of the **flexible bulbous bougie** it is possible to feel the slightest pathological changes in the canal. As the bulb is introduced it glides along the urethra for six inches, until it fetches up against the cut-off muscle, and as it passes through the membranous urethra it is grasped by the muscle, but it feels freely movable again as soon as the posterior urethra is gained. When it reaches the sphincter of the bladder it is slightly grasped again, but slips by and moves freely in the cavity of the bladder.

The same sensations of resistance and grasping are felt on withdrawing the bulb, and we should guard against the error of mistaking the resistance of the cut-off muscle for a stricture in the deep urethra.

As the bulb is moved the *healthy* mucous membrane of the urethra feels soft and velvety, but, when a stricture is impinged upon, a sensation of jolting is felt. There is a perceptible roughness of the walls of the urethra, or one or more fine bands, like fiddle-strings, may be discovered. These changes are more easily felt upon the *withdrawal* of the bulb.

The **metal bulb** is less useful than the flexible bougie, as its smooth, polished surface glides over the roughnesses of the surface without being held by them.

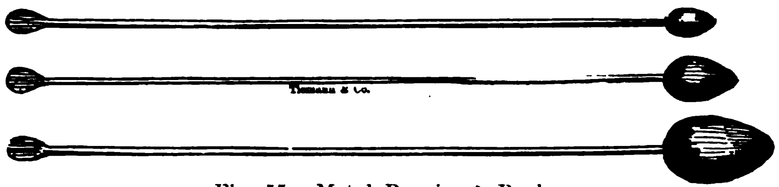

Fig. 55.—Metal Bougies à Boule.

The Otis urethrometer is chiefly used in measuring the *calibre* and determining the dilatability of the urethra. It has the advantage that it can be introduced through a narrow meatus and expanded *behind* the stricture, and we are enabled to measure its calibre with accuracy.

In the case of very tight strictures, in which the calibre is too small to allow the passage of the smallest bulbous bougie, we have recourse to **whalebone filiform guides.**

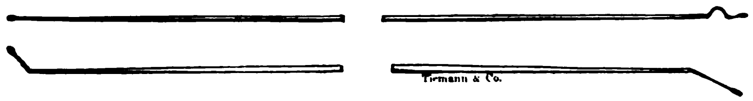

Fig. 56.—Filiform Whalebone Guides.

As long as urine flows out past a stricture we cannot speak of it as impassable, although the difficulty of entering it may be great on account of its fine, narrow lumen or because the opening is not central, but lying off to one side.

In order to find the opening it may be necessary to pass six or eight guides down upon the face of the stricture, and with an assistant holding them firmly in place, try by twisting and manipulating successively one after another, to find the opening through the stricture.

It is always desirable to inject ℥ij of olive-oil into the urethra, to lubricate the canal and distend the narrow opening through the stricture.

Another manipulation, which sometimes succeeds, is to pass a sound down upon the face of the stricture, and hold it pressed firmly against it for ten to twenty minutes. In this way a certain amount of dilatation is often accomplished, and a funnel-shaped depression in the stricture is formed, with the opening at the bottom, instead of being located off to one side, as before.

In not a few instances the opening through the stricture can be discovered by visual inspection through an endoscope.

If great difficulty has been experienced in introducing a guide through a stricture, it is better not to withdraw it and take the chances of getting it in again, but tie it in, and leave it, either for the purpose of continuous dilatation or for operation.

TREATMENT.

All strictures, no matter where they are located, *if soft* and *recent*, are best treated by **gradual dilatation.** After the small round-celled infiltration has become converted into fibrillated connective tissue and is dense and contracted, dilatation no longer meets with the success which would have attended its use in the earlier stages. Even in these old cases, however, we can in many instances enlarge the calibre of the stricture and maintain it subsequently, by means of an occasional passage of a sound, at a size which does not obstruct the urinary outflow. On this account it is always well, in nearly every case, to try the effects of dilatation before proceeding to the more heroic measures of operation.

In private practice, where patients are more regardful of their health, and seek medical advice early, the larger proportion of strictures are amenable to treatment by dilatation. In hospital practice, on the other hand, patients are careless and neglect themselves, and when they do apply for treatment the stricture is apt to be so extensive and so firm and dense that operation is the only resource.

For purposes of dilatation we have recourse to:—

(*a*) Flexible bougies.

(*b*) Steel sounds, with the curve recommended by Van Buren.

(*c*) Kollmann's dilator.

Unlike the operative treatment, we may consider both regions of the urethra together in discussing the treatment by dilatation.

In the case of a stricture, particularly if located in the bulb or

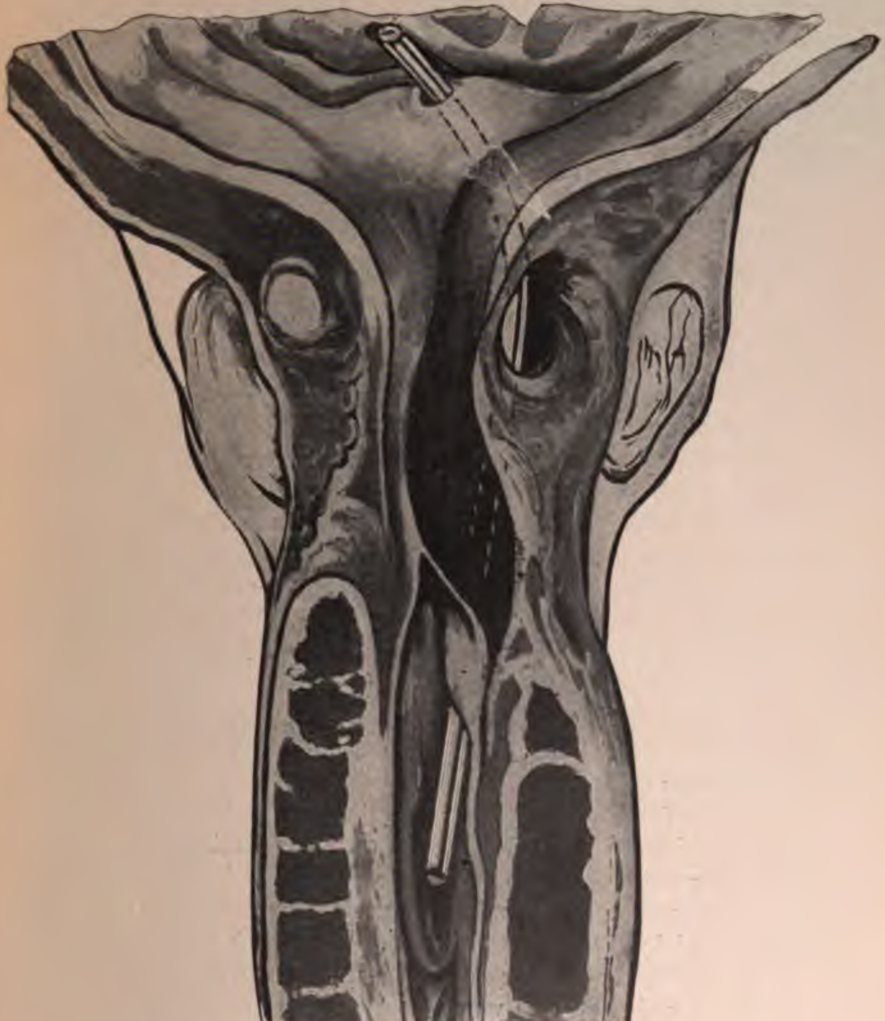

Fig. 57.—Stricture of the bulbo-membranous urethra and false passage. The instrument has been forced through the tissues into the bladder.

membranous urethra, which is **below No. 16 French in calibre,** we should always begin dilating with an **elastic bougie.**

If a metal sound is used, there is always danger of lacerating the inflamed and degenerated mucous membrane and pushing the sound into the periurethral tissue, making a **false passage.** If this accident occurs, the point of the sound is felt to be not in the median line, and is grasped firmly by the tissues, and a forefinger in the rectum readily detects the deflection of the instrument. Free hæmorrhage from the meatus follows the withdrawal of the sound.

The treatment of such an accident consists in rest, urethral antisepsis, urinary antiseptics, and the avoidance of instrumentation for three weeks until the laceration has healed.

In using an elastic bougie we should select a size which is small enough not to lacerate the tissues. When the bougie enters the stricture the sensation of its being engaged and grasped is perceived. If it is held very tightly, rather than attempt to push it ahead, it is better to wait a few moments till the spasm has relaxed, and then push the instrument farther along.

After the elastic bougie has been passed through the stricture, it can be withdrawn at once. There is no object in allowing it to remain, since it is compressible and cannot produce any absorption in the stricture; it simply dilates it mechanically. If the instrument has been introduced with comparative ease, and without much pain, we may then introduce another of a larger size.

At the next sitting, which should not take place before two or three days have elapsed, we should first introduce the number passed upon the former occasion and then use larger sizes.

When the flexible bougie No. 16 French can be introduced with ease, we should begin **gradual dilatation with the steel sound.** It is important for the beginner to cultivate a suitable *technique* in using sounds, as unnecessary pain and sometimes actual damage to the tissues are caused by clumsy manipulation. The sound is sterilized by boiling or passing through the flame of a spirit-lamp, lubricated with vaselin or oil, and should be warm.

As the patient lies upon a table the operator stands upon his left side. Sir Henry Thompson advises that for the moment the operator should *forget* all his *anatomical knowledge*, and let the sound slip through the urethra *by its own weight*, guiding it with the utmost gentleness, and in no case should any pushing, prodding or force be used. This is well accomplished by holding the sound ***stationary*, in** a line with Poupart's ligament, and drawing the penis up over it until the point of the sound has reached the membranous urethra. The sound is then brought into the median line of the body, and as the point passes *through* the membranous urethra the handle will of itself describe the arc of a circle and gradually sink down between the thighs and parallel with them. When the handle is completely depressed, it may be rotated freely from side to side, thus demonstrating that the *point* lies in the bladder and is freely movable.

The largest-sized sound should be selected which will pass through the stricture without using force, withdrawn, and a still larger size introduced. It is desirable, in order to obtain the effect of the *prolonged* pressure, not to withdraw the sound at once, but to leave it lying in the stricture for from five to fifteen minutes.

At the next sitting we should begin with the sound last introduced, withdraw it, and pass the next larger size. The sounds should not be passed too frequently, and the rule is always to *wait until the reaction has subsided* before passing the sound again. The intervals vary, depending on the amount of reaction, from four to seven days.

There are different views as to the extent to which it is necessary to carry the dilatation, some authorities claiming that No. 25 French is sufficient, others maintaining that No. 30 French is the proper calibre. In any case there is always danger of *recontraction* unless the sound is passed at occasional intervals, in order to maintain the maximum calibre, for at least eighteen months. We can introduce the sound every week, and then increase the intervals to once in two, four, six, eight, and twelve weeks.

Effects upon the stricture of passing sounds are twofold, according to Oberlaender and Wossidlo:—

I. The mechanical stretching to which it is subjected.

II. A change in the vital functions of the tissues.

As a result of the distension, small *tears* occur in the mucous membrane or the stricture-tissue, as evidenced by slight bleeding. In a few hours a profuse mucous secretion occurs, indicating that a melting of the stricture-callus is taking place in consequence of the reaction. Under the increased vascularization which sets in, the stricture is partially absorbed.

After dilatation to No. 25 or 30 has been accomplished, the sound only acts upon the *narrowest* part of the stricture, and when it lies loosely here it accomplishes nothing further in the way of producing *absorption* of the stricture-callus, but only keeps its calibre *mechanic-*

ally dilated. But in many cases the stricture-tissue begins to recontract as soon as the use of sounds is discontinued.

Oberlaender claims that by dilating the stricture to more than No. 30 French, even 40 or 45, the fibrous tissue of the stricture is transformed into a "dead scar," which has no longer any tendency to contract. He states that, by systematic examinations with the endoscope, an evident improvement, which is perceptible to the eye, occurs only after the dilatation of the urethra has *exceeded* No. 30 French.

When the meatus is of normal size, it will not admit a sound large enough to accomplish this result, and, even if meatotomy is done, the meatus can only be cut to a size sufficient to admit a No. 30 French sound, and this calibre is not enough to accomplish the *overdistension of* the urethra, according to the views of Oberlaender. On this account he has devised the **Oberlaender dilator,** which can be introduced, with the blades closed, through a small meatus; after it is in place the blades are separated by turning the screw at the end, and we can get any amount of distension of the urethra which we may desire, even as high as No. 45 French. It should be distinctly understood that *forcible dilatation* or divulsion is not intended, but only a *gradual* and *temporary* dilatation of the stricture.

Kollmann's dilator is a modification of Oberlaender's original idea, and is to be preferred because it is made with four dilating blades and is less apt to cause a laceration of the urethra than Oberlaender's instrument.

Technique.—The urethra is cocainized, and the dilator, which is provided with a rubber cover, is oiled and introduced. If the sound which was passed on the case previously was No. 26, we separate the blades of the dilator to one number higher: *i.e.,* to No. 27.

The blades should be separated very slowly, and after we have screwed them apart *one* number, as indicated on the dial, we should wait until the pain has subsided, and then increase the separation to the next higher number.

After each dilatation a muco-purulent secretion occurs, which indicates the melting and absorption of the stricture-callus. If the discharge is profuse in quantity, it indicates that the stretching has been too vigorous. The usual intervals for dilatation are about ten days, on the average; and at each sitting the dilatation should be increased from one to two numbers.

The extent to which the stricture should be finally dilated is a matter of individual experience, and beginners generally make the mistake of dilating too rapidly. A sharp bleeding or an excessive secretion following dilatation is an indication that an error has been made in the technique, and that the dilatation has been too rapid or too great. If such an accident occurs it is necessary to wait from three to six weeks, until all tenderness of the urethra has disappeared and the secretion has diminished and is but slight in amount.

In regard to the extent to which dilatation should be carried before the stricture can be said to be cured, Oberlaender states that the endoscope is the only guide. The grayish white color of the mucous membrane changes and it becomes pink and vascular and the fibrous tissue becomes transformed into a "dead scar," which has no longer any tendency to contract. As soon as this condition is attained, all further dilatation can be suspended, quite irrespective as to whether the stricture has been dilated to No. 28 or 30, or to 40 or 45 French.

As a general rule, Wossidlo states that it is necessary to dilate up to 36 or 38 so that relapses do not occur, but, as with the use of sounds after active treatment has ceased, the stricture should be dilated, with the dilator, at occasional intervals to prevent relapses.

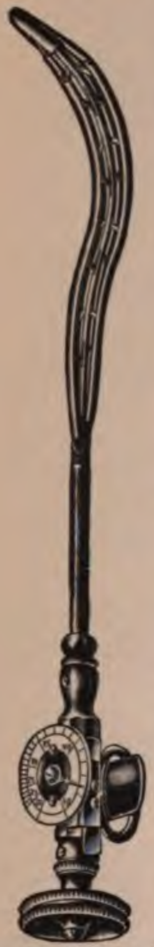
Fig. 58.—Kollmann's Antero-Posterio Dilator.

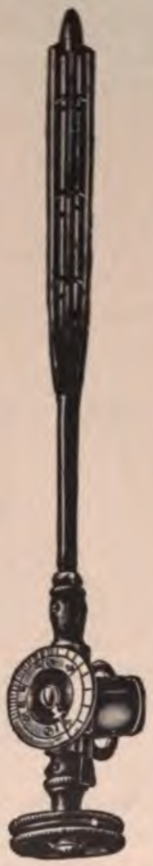
Fig. 59.—Kollmann's Dilator for the Anterior Urethra.

Relapses sometimes occur, and can be recognized by the endoscope and treated with dilatations again, before any decided contraction has had time to occur. For this reason, it is desirable to examine

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cases with the endoscope at intervals of three or six months after treatment has ceased.

With reference to treatment by dilatation, strictures may be divided into two classes, *absorbable* and *non-absorbable*. Those which cannot be absorbed can still be held in abeyance by a course of dilatations with sounds up to 30 or 32, and they may be kept at this point without contracting again, by an occasional dilatation. The frequency of the dilatation will depend entirely upon the tendency of the stricture to recontract.

The length of time required to dilate a stricture is also very variable.

Some strictures can be dilated in a few weeks, and others, in which the ring of scar-tissue is extensive and very dense and fibrous, will require months of patient effort.

The only means of determining whether a stricture can be treated by dilatation, is by making the attempt and observing the progress.

The opinion is now generally held, and particularly in Europe, that the great majority of strictures are amenable to treatment by dilatation, and operative treatment is seldom called for, provided the individual has sufficient patience and time to undergo the protracted course of treatment which is necessary.

In private practice it is found that most of the strictures can be successfully treated by dilatation, and it is rarely necessary to operate. The patients who enter the hospitals in a large city are of a different class. Their strictures have usually been neglected and have become very tight, and they have not the necessary time or even inclination to allow of treatment by gradual dilatation, so that from force of circumstances the genito-urinary surgeon is most frequently obliged to treat his hospital patients by surgical operation.

Strictures of very small calibre, which are so tight as not to permit the passage of the smallest flexible bougie, can often be penetrated by means of the **filiform whalebone guide.** After this instrument has penetrated the stricture and the end has entered the bladder, there are three courses open to us:—

(a) Continuous Dilatation.—If a bougie is passed through a stricture which grasps it tightly and is left in place for twenty-four hours, the stricture ulcerates superficially, but *widens rapidly*, so that the bougie lies loosely within it, and can be withdrawn, and a larger instrument introduced to take its place.

In cases of retention of urine, a guide may be left tied in the bladder, and the urine escapes, flowing away alongside of the guide.

On the following days larger instruments may be introduced and tied in until the stricture is sufficiently dilated to admit being treated with sounds.

During the course of treatment the patient lies in bed, and it is possible in this way in the course of a week or two to dilate a very tight stricture so that a good-sized instrument can be passed.

Continuous dilatation, which formerly was much in vogue, is seldom used at the present day. Methods *b* and *c* have taken its place.

It has, however, a certain field of usefulness in a few selected cases.

(b) Tunneled Sound and Gradual Dilatation.—A tunneled sound is threaded over the guide and introduced through the stricture, dilating it. The sound is then withdrawn, and a larger one introduced. in the same way. This is a very useful method of treating tight strictures, which are not too hard and fibrous to admit of gradual dilatation.

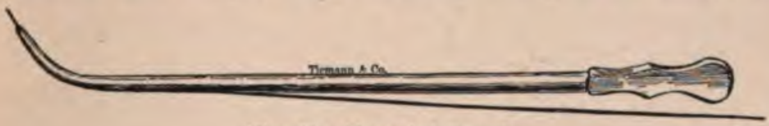

Fig. 60.—Tunneled Sound.

In case of retention of urine, where it is necessary to relieve a distended bladder, *Gouley's tunneled catheter* can be used in place of the tunneled sound, and the urine withdrawn through it, by pulling out the stylet and thus making the hollow shaft permeable.

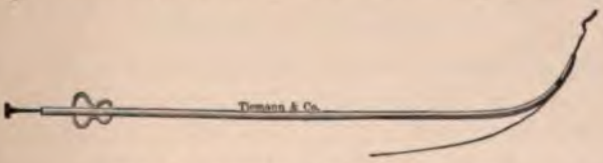

Fig. 61.—Gouley's Tunneled Catheter.

(c) Immediate Operation.—Internal urethrotomy by Maisonneuve's urethrotome or external urethrotomy. (See the following section on the operative treatment of stricture.)

TREATMENT OF STRICTURE BY SURGICAL OPERATION.

[illegible] stricture, no matter in [illegible] treated by gradual dilatation [illegible] stricture becomes older, it [illegible] gradual dilatation is no longer [illegible]

[illegible] cutting through the [illegible] and we employ two [illegible] —

[illegible]

[illegible] upon the point in [illegible] for the purpose of [illegible] divide the urethra [illegible] —

[illegible] for a distance of [illegible] the peno-scrotal junction [illegible]

[illegible] urethra. It [illegible] the meatus back as far [illegible]

[illegible] the meatus is [illegible] through a perineal [illegible] Region II.

INTERNAL URETHROTOMY

Preparatory Treatment. [illegible] urethra the [illegible] urotropin. [illegible] citrate or [illegible]

[illegible] of mercury [illegible]

[illegible] by [illegible] after the [illegible] when the

Anæsthetic.—A 4-per-cent. solution of cocaine is, as a rule, sufficient, unless in the case of very extreme strictures, which require a general anæsthetic.

The **technique** of internal urethrotomy is as follows: If the meatus is small, it should be incised on the floor to No. 30 French, and any stricture-bands which are within an inch of it should be divided at the same time with a straight, probe-pointed bistoury.

The Otis urethrotome, preferably with Rand's modification, is introduced into the urethra closed. After its point has entered *behind* the stricture the blades are separated, by means of the screw, to the full extent the calibre of the stricture will allow. The instrument is then withdrawn until the projection at the end catches against the stricture and is held. We know by the feeling of resistance that the projection which conceals the knife lies in close contact with the point we wish to cut. The knife is then withdrawn for an inch, cutting through the stricture, and toward the *roof* of the urethra. And we can afterward readily demonstrate that the stricture has been cut through by separating the blades more widely than was before possible.

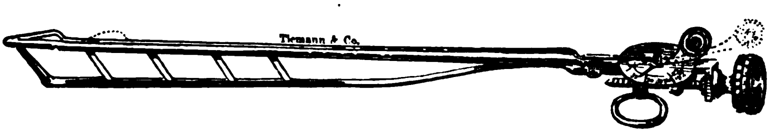

Fig. 62.—Otis Urethrotome, as Modified by Rand.

The knife is again pushed back into its place of concealment in the instrument, and the urethrotome is drawn out toward the meatus, and any other stricture-bands present are cut in the same way.

In every case treated by internal urethrotomy the question arises: "How deep shall we make the incision through the stricture?" This is still a point under discussion, since almost every author has his own line of procedure. Dr. Otis devised a scale of measurements of the penis, as a guide to depth of the incision, and claims that a penis three inches in circumference should be cut to admit a No. 30 French sound, while a penis four inches in circumference should be cut so that a No. 38 sound can be passed.

I believe we will have better results by treating each case on its *individual merits*. The stricture which is comparatively *light* and does not involve the whole corpus spongiosum may be *completely* divided, as shown by the entire *absence of resistance* when the blades of the urethrotome are separated, after cutting the stricture.

In the case of a *heavy* stricture which involves all the corpus spongiosum we cannot divide the whole thickness of the stricture, but must content ourselves with cutting it through *partially*, and trust to keeping the channel open by passing sounds *frequently* for the rest of the patient's life.

After the stricture has been cut to the extent which we desire and the urethrotome has been withdrawn, a bulbous bougie, No. 30 or 32 French, is introduced into the canal, to make sure that all the bands are completely divided.

After-treatment.—The patient should be kept in bed for a week, and on light diet, and directed to drink freely of water and milk to dilute the urine.

In order to keep the cut surfaces from growing together, a straight sound can be passed every other day for the first two or three weeks, and, after a month, once a week. Later the passage of the sound need only take place once a month; but there is always danger of [illegible] unless a sound is passed at intervals.

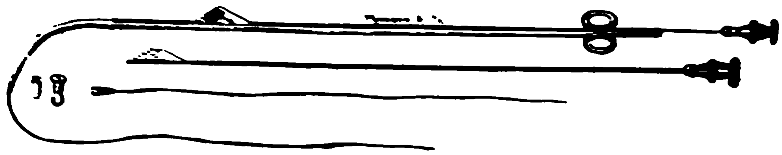

Fig. 63.—Maisonneuve's Urethrotome.

Dangers of Internal Urethrotomy.—Mortality, 2 to 3 per cent.

1. Hæmorrhage.

2. Infiltration of urine through wound into tissues, producing abscesses and [illegible].

[illegible] it is especially important to see that the [illegible] urethrotomy.

3. [illegible]

When a [illegible] a large amount of [illegible] is formed [illegible] subsequently contracts, [illegible] which causes [illegible].

Strictures of small calibre, under No. 15 French, are not large enough to allow the passage of an Otis urethrotome. In these cases a filiform guide should be passed through the stricture and by means of (*a*) Maisonneuve's urethrotome the stricture can be divided, from before backward, and afterward cut larger with an Otis urethrotome, or we can introduce over the guide (*b*) a divulsor and *stretch* the stricture so that an Otis urethrotome can be used.

The operation of **divulsion** as formerly practiced has been entirely superseded, as it is inexact and dangerous, producing extensive lacerations of the urethra, which are followed by hæmorrhage and septic absorption.

Summary of Indications for Internal Urethrotomy.—This operation is applicable only to stricture of the pendulous urethra which is dense and fibrous and cannot be treated by gradual dilatation with sounds, and located *less than five inches* from the meatus.

It is especially adapted to the following varieties:—

(*a*) Distinctly fibrous or non-dilatable stricture.

(*b*) Resilient stricture. (*Definition:* Elastic and India-rubber-like, contracting quickly after instrumentation.)

(*c*) Irritable stricture. (*Definition:* Standing instrumentation badly and easily excited to inflammation.)

(*d*) Cases where urethral fever follows each introduction of a sound.

When a stricture is located *more* than five inches from the meatus, internal urethrotomy is no longer a suitable operation, on account of the danger of **hæmorrhage**, which is difficult to control. The blood flows backward, overcomes the resistance of the cut-off muscle, and fills the bladder.

The means of controlling the bleeding are as follows:—

(*a*) Pressure on the perineum by means of a crutch, firmly applied against it.

(*b*) Introduction of a full-sized catheter into the bladder, which makes pressure on the urethral walls and closes the bleeding vessels.

(*c*) Perineal section and introduction of a catheter through the wound into the bladder, with firm gauze packing around it.

Another danger is **infiltration of urine**, which soaks into the tissues through the cut and produces *abscess* and *sepsis*.

EXTERNAL URETHROTOMY.

In consequence of the dangers of hæmorrhage and infiltration of urine, we have recourse to the operation of external urethrotomy through the perineum when the stricture is located in the **bulbous** or **membranous** urethra, viz.: in Region II.

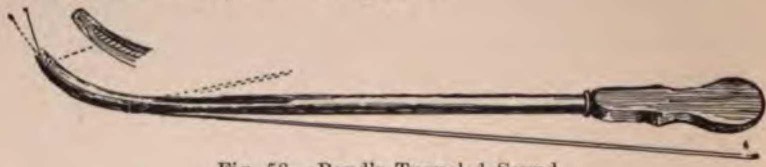

Fig. 58.—Rand's Tunneled Sound.

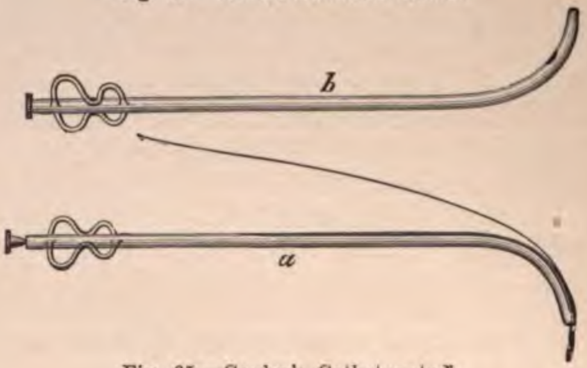

Fig. 65.—Gouley's Catheter-staff.

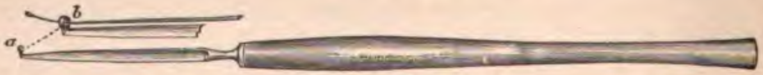

Fig. 66.—Tunneled Knife.

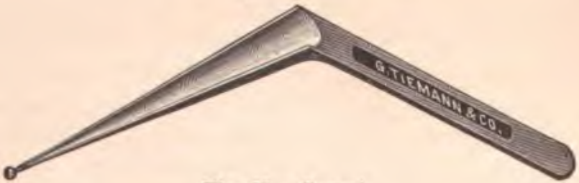

Fig. 67.—Gorget.

Forms of Operation.—(*a*) With a filiform guide: Gouley's operation, modified by Rand.

(*b*) Without a guide: Wheelhouse operation.

Gouley's Operation With a Guide.—*Technique.*—A *filiform guide* is introduced through the stricture and into the bladder and a tunneled sound is slid over the guide, till its point rests against the stricture. The urethra is opened in the perineum, by cutting down upon the end of the tunneled sound.

The sound is withdrawn, the guide being held with forceps, to prevent its being pulled out of the bladder.

The free end of the whalebone guide is then brought out through the wound (the other end remaining *in situ,* in the bladder). Rand's tunneled knife is then threaded over the guide and pushed *through* the stricture, dividing its fibres sufficiently to admit a gorget, which is carried into the bladder. Any remaining stricture-bands which have not been severed by the tunneled knife should now be divided on the *floor* of the urethra with a blunt-pointed straight bistoury, using the gorget as a director.

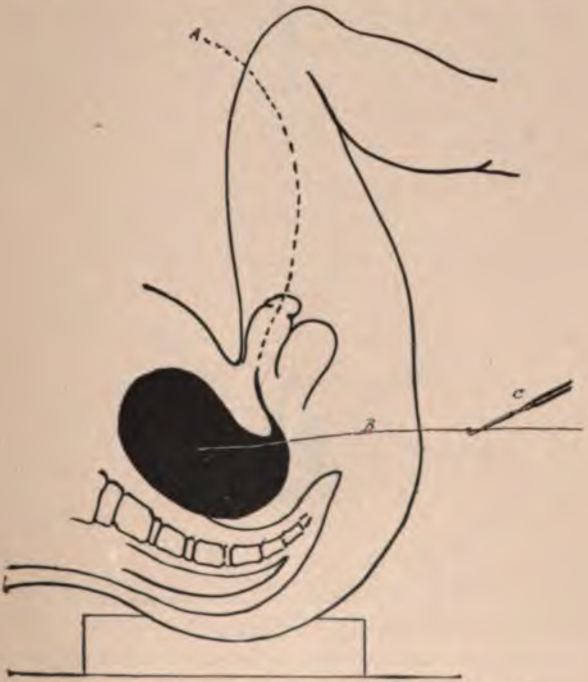

Fig. 68.—External Urethrotomy with a Guide.

A, Guide Introduced into Bladder.
B, End of Guide Drawn Out Through Perineal Incision.
C, Tunneled Knife.

The vesical sphincter may then be dilated with a uterine dilator and the examining finger introduced into the bladder. Thorough search should now be made with the finger to exclude the presence of a calculus, which may have existed unsuspected, its symptoms being masked by those of the stricture.

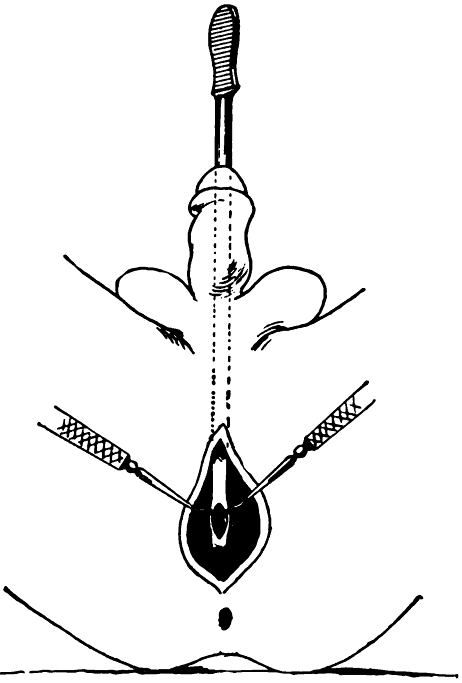

Fig. 69.—External Urethrotomy—Wheelhouse Operation. Urethra exposed and incised, edges retracted by small hooks.

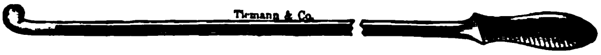

Fig. 70.—Wheelhouse Staff.

The operation of external urethrotomy is rendered comparatively simple, if we are able to introduce a filiform guide into the bladder, and it may be impossible to reach the bladder without the assistance furnished by the guide.

For that reason it is desirable not to wait until the last moment before the operation, but to begin the attempt to introduce a guide on the day before. If the first attempt fails, a number of subsequent trials may be made at different sittings, at one of which the guide generally slips in.

After the guide has once been introduced into the bladder through a very tight stricture, it is much safer to tie it in and leave it, rather than withdraw it and take the chances of failure in attempting to reintroduce it just before the operation.

When all attempts at the introduction of a guide are unsuccessful, the only remaining resort is the operation of

External Urethrotomy Without a Guide, as Devised by Wheelhouse.—*Technique.*—A Wheelhouse staff is introduced into the urethra, till its end rests against the face of the stricture. The urethra is opened through the perineum, cutting down upon the end of the staff. The wound in the urethra is retracted by small hooks on either side, and the upper angle of the wound is held up by hooking the projecting end of the staff against it and drawing it as much out of the way as possible.

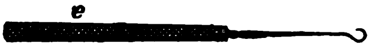

Fig. 71.—Small Tenaculum for retracting urethral wound in External Urethrotomy.

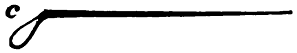

Fig. 72.—Arnott's Grooved Probe.

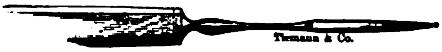

Fig. 73.—Gouley's Beaked Bistoury.

Search is then made for the distal end of the urethra by means of Arnott's grooved probe or a filiform guide and by inspection. If the opening is found and the probe introduced, a Gouley knife is slipped along the groove in the probe and the stricture is cut through.

The chief difficulty, in the operation of external urethrotomy, consists in finding that part of the urethra which lies between the stricture and the bladder.

If the surgeon loses his way and misses the urethra, he may flounder about in the tissues of the perineum indefinitely, and ultimately have to give up his attempt to reach the bladder.

In order to avoid the danger of losing the urethra, it is essential to partially dissect out and free the urethra at the sides, so that it stands out prominently in the perineal wound as it lies distended by the staff.

After the incision is made in the urethra, the edges of the urethral wound should be well retracted by a small hook at either side, and but little difficulty will be experienced in slipping Arnott's grooved probe through the lumen of the stricture with the deep urethra and bladder beyond.

In case of failure to find the opening we may have recourse to **Guitéras's trocar.** The rami of the pubis form a triangle, with the symphysis at the apex. The urethra lies immediately under and one-half inch below the symphysis.

If our anatomical knowledge enables us to locate the urethra accurately, by *stabbing,* in the proper place with the trocar, we will puncture the stricture-tissue, and the trocar will lie in the prostatic urethra beyond, as can be demonstrated by pushing the trocar along through it, until it reaches the bladder, and withdrawing the stylet, when a stream of urine will flow through the hollow cannula. A knife is then introduced along the groove in the instrument and the stricture divided in the usual way.

In the event of this procedure not being successful we may have recourse to **retrograde catheterization.** This operation consists in doing a suprapubic cystotomy and introducing a staff into the bladder and through the prostatic urethra and along the canal until its further progress is barred by the stricture, through which it cannot pass. The end of the staff is felt, covered by stricture-tissue, by means of a finger in the wound, and the tissue which intervenes between the end of the staff and the perineal wound is cut through with a knife, in this way bringing the end of the staff into view in the wound. The urethra is thus made again one continuous canal.

We may have recourse to still another procedure, which is to let the patient recover from his anæsthetic and when consciousness is restored and the bladder is full of urine, if the patient endeavors to pass water, a few drops of urine may be seen to escape at one point in the perineal wound, thus indicating the location of the end of the urethra, which had not been discoverable before.

Treatment After External Urethrotomy.—*Hæmorrhage* during the operation is controlled by clamping the bleeding vessels with artery-forceps, which, if necessary, may be left *in situ* for twenty-four hours in the wound, before being removed. As a rule, this is unnecessary, as the general oozing can be perfectly controlled by firm pressure by means of gauze, packed into the wound and around the catheter.

It is very essential to pack the gauze in *tightly*. The author has known of several cases where the gauze was packed in loosely and did not exert enough pressure to control the bleeding, and the patient had secondary hæmorrhage from two to four days after the operation. The bleeding occurred at night and was not discovered until too late to save the patients' lives.

The treatment of secondary hæmorrhage consists in taking out the gauze and clamping any bleeding points, if they can be seen; or a firm repacking of the wound with gauze will probably control the hæmorrhage.

Saline injections, transfusion, or hypodermoclysis, together with strychnia hypodermically, are, of course, indicated in such a condition.

An important indication is to secure *good drainage of the bladder* and prevent the urine from coming in contact with the freshly-made wound until septic absorption is guarded against by the formation of granulations. This is readily accomplished by carrying a No. 30 French catheter through the wound and into the bladder, and taking a stitch through both lips of the wound and the catheter to prevent it from being forced out. The end of the catheter is attached to a long tube, which drains into a bottle on the floor.

In a case where, in addition to cutting a stricture in the deep urethra, a stricture in the anterior part of the canal has been divided by internal urethrotomy, a straight sound should be passed through the meatus and anterior urethra down to the catheter on the second day after the operation and upon every alternate day until the drainage tube is removed from the wound and bladder. The gauze packing should be removed from around the tube in forty-eight hours and the wound irrigated and repacked. It is desirable to irrigate the bladder with oxycyanat of mercury 1-4000 once or twice a day. About the seventh day after the operation, when granulations have formed,

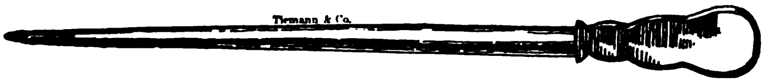

Fig. 74.—Straight Steel Sound.

the catheter is removed from the wound and a curved sound passed through the meatus into the bladder. The sound is passed every second day into the bladder until the perineal wound is healed and the patient discharged.

The patient may be allowed to get out of bed and sit in a chair a week after the operation, and the ability to hold the water and pass it at will is regained about the same time.

Recontraction of the stricture is almost certain to take place, after division of a heavy stricture, unless a sound is passed at occasional intervals, for the rest of the patient's life, and this fact should be earnestly impressed upon him, so that he may not neglect the precaution.

Résumé.—External urethrotomy is applicable *only* to strictures located *more* than five inches from the meatus, *i.e.*, in the bulbous and membranous urethra.

Summary of indications:—

(*a*) Rupture of urethra.

(*b*) Urinary infiltration.

(*c*) Impassable stricture complicated by retention of urine.

(*d*) Tough fibrous stricture of small calibre which is difficult to dilate.

(*e*) Traumatic stricture.

MISCELLANEOUS.

Stricture at the meatus may be congenital or the result of gonorrhœa. In these cases dilatation is useless, and the proper procedure is meatotomy, which is accomplished by cutting the meatus upon the *floor* by means of a straight probe-pointed bistoury.

There is a tendency on the part of the cut surfaces to unite afterward, which is counteracted by *dilating* the meatus three times daily with a sound, or preferably a glass cone.

Stricture Complicated by a False Passage.—A large number of cases of *old* deep-seated stricture, which have been under instrumentation a number of times, are apt to have one or more false passages, which have been made by the bungling use of a sound.

A false passage adds to the difficulty of entering the bladder with a catheter or sound, because it is very apt to engage the point of the instrument and "pocket" it.

In these cases the *filiform bougie* is very serviceable in furnishing a guide into the bladder. Our plan of procedure is to introduce one guide after another through the urethra, in hopes that one of them will slip *past* the opening of the false passage, pass through the stricture, and thus into the bladder.

Combined external and internal urethrotomy is always demanded when both pendulous and bulbous portions of the urethra are the seat of strictures.

It is also often a good plan to open the deep urethra and drain the bladder with a catheter after an extensive internal urethrotomy, in order to prevent the urine from passing over the fresh-cut surface in the urethra and causing urinary fever.

PERINEO-URETHRAL FISTULA.

Occasionally after an external urethrotomy a permanent fistula is left in the perineum, which communicates with the urethra.

This is particularly liable to occur when a patient has been operated on several times for stricture by external urethrotomy, and when a considerable amount of scar-tissue has formed in the perineum.

Urethroplasty frequently fails in these cases, because the urine leaks into the stitch holes, causing suppuration and separation of the wound-surfaces.

The author has succeeded in healing some intractable fistulæ which had been previously operated upon unsuccessfully, by the following method:—

The patient is placed in the lithotomy position and a sound introduced through the meatus into the bladder.

The cicatricial tissue surrounding the edges of the fistula is dissected away and the perineal tissues separated from the urethra.

The edges of the fistulous opening in the urethra are then freshened and brought together and held by catgut sutures.

The perineal wound is then closed by means of silver-wire sutures and the bladder is drained with a retained Pezzer catheter or the patient is catheterized every four hours. The latter method is to be preferred, if competent nursing is at hand.

Firm union generally takes place at the end of a week and the silver-wire sutures may be removed.

TREATMENT OF INTRACTABLE STRICTURE BY RESECTION OF A PORTION OF THE URETHRA.

Occasionally dense fibrous strictures of the deep urethra, with a large amount of periurethral induration, are met with, which are sometimes gonorrhœal, but generally traumatic, in origin.

Such patients have usually had their strictures divided by external urethrotomy several times, but, in spite of the regular passage of sounds, they contract rapidly, and it is impossible to keep them open.

A conservative method of dealing with such cases is to lay bare the urethra and excise the strictured portion.

This was first done by König in 1882, who cut out the strictured portion of the urethra and brought the separated edges again into apposition and stitched them together. In 1892 Guyon and Albarran resected strictures and allowed the space between the cut ends of the urethra to fill in with granulations.

The author has used the method devised by Fuller with satisfactory results.

Technique.—A sound is introduced through the meatus and the perineal urethra exposed by dissection. If the bulbous urethra is involved, the scrotum must be split in two halves in order to lay the urethra bare. The strictured portion of the urethra is entirely excised with curved scissors, with the exception of a narrow bridge of urethral tissue one-quarter of an inch wide on the roof.

A large catheter is inserted at the lower angle of the perineal wound to drain the bladder, and a No. 26 French soft catheter is passed through the meatus and perineal urethra, till its end rests against the perineal tube. The perineal tissues are then sewed around the urethral tube with catgut, thus building up a channel which will eventually form the new urethra.

The skin-edges are then brought together with superficial sutures, and, if the scrotum has been divided, a couple of deep silk-worm-gut sutures may be introduced.

Both tubes may be removed in one week, but a sound should not be passed for three weeks.

EXTRAVASATION OF URINE.

Extravasation of urine is one of the severest and most dangerous complications which occur as a result of stricture. It is by no means uncommon, and Sir Henry Thompson found it occurring 8 times out of 217 cases of stricture.

In its attempts at evacuation, the straining and pressure of the hypertrophied bladder cause a rupture of the thin walls of the pouch-like dilatation of the urethra, lying behind the stricture, and the urine escapes into the periurethral cellular tissue.

When, as is most frequently the case, the rupture occurs *in front* of the subpubic ligament, the urine burrows through the cellular tissue of the scrotum and penis and extends upward toward the hypogastrium.

Abscess rapidly forms, the tissues become gangrenous and slough, and spontaneous evacuation of the pus and urine occurs with considerable destruction of tissue, leaving urinary fistulæ. The septic condition is always very pronounced, and such patients usually die unless an operation is performed promptly after the rupture occurs.

When the rupture of the urethra takes place *posterior* to the subpubic ligament, the burrowing of urine takes place in a different direction. In this case the urine cannot make its way forward through the cellular tissue of the penis, but it burrows under the deep layer of the perineal fascia and accumulates in the prevesical space, forming a swelling above the symphysis. From this point it extends, and inflammatory swelling and suppuration of the connective tissue within the abdomen occurs and the patient dies of pyæmia.

TREATMENT.

Urinary extravasation demands immediate operation in order to save the patient's life and prevent extensive sloughing and loss of tissue.

An external urethrotomy should be performed and the bladder drained through a catheter in order to prevent further escape of urine into the tissues. At the same time the collections of pus and urine in the tissues should be opened up, drained freely, and packed with gauze.

If the prostatic urethra was ruptured behind the subpubic liga-

[illegible] the peritoneal space, the [illegible] means of a suprapubic incision.

RETENTION OF URINE

[illegible] the surgeon [illegible]:—

(a) **Retention of urine in the bladder.**

(b) **Suppression of urine** from a failure on the part of the kidneys.

(c) **Rupture of the bladder.**

[illegible] the bladder shows it to [illegible] draws no water.

Rupture [illegible] instances, from a chronic ulcer being [illegible] of the bladder-wall. [illegible] falling upon his abdomen [illegible] distended with urine.

In making a diagnosis, a catheter is introduced through the urethra and little or no urine flows out; a measured quantity of water is then injected into the bladder with a syringe, and the full amount introduced does not return.

Having excluded rupture of the bladder and suppression of urine, we know that we are dealing with a case of retention of urine, which may arise from the following causes:—

I. **Stricture,** which may be spasmodic or organic.

II. **Enlarged prostate,** from senile hypertrophy or gonorrhœal inflammation.

III. **Foreign body impacted in the urethra,** as a calculus which has formed in the bladder and undergone spontaneous fracture, and a piece become fixed in the urethra; or some article may have been introduced into the urethra from without, for purposes of masturbation.

IV. **Paralysis of the bladder,** occurring in typhoid and other continued fevers, or from myelitis, hemiplegia, and other nervous affections.

In order to determine which of the above conditions is responsible for the retention, a systematic method of examination is to be recommended.

Percussion over the suprapubic region gives a flat note with a full bladder and the bladder can often be felt extending upwards toward the umbilicus.

The condition and size of the *prostate* should be ascertained by rectal examination.

In cases of paralysis of the bladder no difficulty is experienced in introducing a catheter; but if the retention is due to stricture, the catheter fails to pass and the urethra should be explored with a steel sound.

If the stricture is purely *spasmodic*, a large-sized sound will generally overcome the spasm and slip into the bladder; but if the stricture is *organic*, the sound is arrested.

In very tight organic strictures which do not admit a steel sound, a filiform guide can usually be introduced.

TREATMENT.

If the retention is due to stricture, either organic or spasmodic, a quarter or half a grain of morphia given hypodermically, in conjunction with a full hot bath for half an hour, often relieves the retention.

Before using the hot bath, however, an attempt should always be made to pass a catheter, either soft rubber, woven silk, or silver. If the silver catheter is used, extreme care should be taken to avoid making a false passage.

Before passing an instrument into the bladder in any case of retention of urine, the urethra should be injected with a 4-per-cent. cocaine or 2-per-cent. eucaine solution, and very thoroughly irrigated with a 1 to 4000 oxycyanat-of-mercury solution, in order to prevent the subsequent dangers of cystitis and urinary fever.

A spasmodic stricture is always overcome by the above measures, but an organic stricture generally proves more rebellious.

In an organic stricture, when a catheter cannot be passed, the surgeon can usually relieve the retention by means of a filiform guide, introduced into the bladder with Gouley's tunneled catheter slipped over it.

Passing the filiform guide may be facilitated by filling the urethra with sweet oil by means of a syringe.

Adrenalin solution injected against the face of the stricture often causes it to shrink and open so that a guide will pass.

Sometimes it is possible to see the opening through the stricture, by means of a urethroscope, and the guide can be passed under the direction of the eye. After the guide has entered the bladder and the urine has been drawn off with a Gouley catheter, the practitioner is called upon to decide the question as to whether the patient shall be treated by *continuous dilatation* or by *operation*.

If a surgeon of experience can be secured, a stricture which is so tight that it will only admit a filiform guide is best treated by urethrotomy; but if the patient does not consent to operation, continuous dilatation will generally enlarge the stricture so that it can be subsequently treated with sounds.

In the cases where a guide fails to enter, the distended bladder may be emptied by plunging an aspirating needle through the abdominal wall, a finger's breadth above the pubis, and drawing off the urine with the aspirator. This affords only a temporary relief, as it cannot be repeated more than once, on account of the danger of infection of the punctures and the leakage of urine into the space of Retzius. The last and only resource in these cases is external urethrotomy without a guide.

In the cases where the retention of urine is due to **enlarged prostate,** the treatment must be conducted on entirely different lines.

Here it is better not to waste time with a hot bath, but use the catheter at once.

In gonorrhœal prostatitis the urethra should always be washed out thoroughly before passing the catheter, to prevent infection of the bladder.

In senile hypertrophy of the prostate, the distended bladder should never be emptied at one sitting, but a few ounces of urine or boric acid solution should be left in.

If the bladder is emptied entirely there is some shock, the distended blood-vessels lose their accustomed support and bleed freely, and a cystitis is always aggravated if already present.

If a **foreign body impacted in the urethra** is the cause of the retention, it may sometimes be extracted with long urethral forceps.

A foreign body, however, usually calls for operation, either perineal section, or, if the body is large and lies in the bladder with part projecting into the urethra (pipestem calculus), suprapubic cystotomy may be required.

If the stone is impacted in the pendulous urethra, it may be cut down upon directly through the skin and urethral tissues. Such always heal readily by granulation without leaving a fistula.

CHAPTER X.

URINARY FEVER.[1]

Urinary fever is also spoken of as urethral fever or catheter fever, and may be defined as a set of symptoms of which chill and fever are the most prominent, generally occurring in consequence of a traumatism to the genito-urinary tract. It occurs in two forms: acute and chronic.

Acute Form.—Shortly after instrumentation of the urethra or bladder—*i.e.*, passing sounds, dilatation, urethrotomy, or cystoscopy —a chill occurs, lasting half an hour or more and followed by fever, and the urinary secretion is lessened or entirely suppressed. After a few hours the temperature falls, with profuse sweating, the kidneys begin to secrete freely again, and the urine contains abundant urates and sometimes albumin.

The chronic form may result as the outcome of an acute attack or may be developed insidiously without attracting the attention of the patient, who only complains of malaise, dyspepsia, etc. The course of the fever is prolonged, and the patient loses strength and emaciates and is often mildly delirious at night. This condition is generally combined with severe cystitis and often pyelitis, and in the end the patient succumbs to the cachexia induced by the chronic poisoning.

PROGNOSIS.

Urinary fever is a serious disease, especially in old men or with those having diseased kidneys. The most important factor in the recovery of *acute* cases is the freedom with which the kidneys secrete urine, and, when the kidneys do not resume their function after an acute attack or were previously diseased, the outlook is grave.

ETIOLOGY.

Urinary fever was formerly thought to be due to the shock and disturbance to the nervous system, attendant upon passing an instrument into the urethra, and this view is still held by many authorities, but it is generally regarded at the present time as an ***infectious disease*** which is brought about by the entrance of pathogenic organisms into the blood-circulation, through wounds or lacerations of the urethra or bladder. Among various other organisms the Bacterium Coli Communis plays an important part in the causation of urinary fever.

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[1] "Die Stricturen der Harnröhre," by H. Wossidlo.

Micro-organisms are introduced into the blood-circulation in the following ways:—

(*a*) The sound or dilator may be dirty and infected with germs, which are introduced into an accidental laceration made in the mucous membrane by the instrument.

(*b*) The instrument is clean, but the urine is septic and contains micro-organisms from a cystitis or pyelitis, and the attack of fever follows very soon after the first passage of urine through the urethra. The micro-organisms in the urine pass into the blood through an accidental laceration in the mucous membrane and occasion the attack.

(*c*) When instrument and urine are both sterile, pathogenic organisms may be already existent in the urethra, lying especially in the parts *behind* a stricture, and are introduced into the circulation through a traumatism.

The *course of the fever* depends upon the size of the wound and the quantity of micro-organisms absorbed. If a small amount of septic material is taken up in oft-repeated doses, the fever runs a chronic course.

In case the kidneys were diseased and incapable of eliminating waste-products completely before the onset of the fever, the attack is more severe, inasmuch as the kidneys fail to excrete the products of nitrogenous waste and, in addition, cannot clear the blood of the accumulated toxins.

TREATMENT.

Prophylaxis.— In order to avoid urinary fever the following conditions are necessary:—

I. Healthy kidneys. As already stated, imperfect elimination of urea predisposes strongly to urinary fever; hence it is important to ascertain that the kidneys are healthy before operating on the urethra.

II. Complete asepsis of instruments and genito-urinary tract. It is easier to secure asepsis of instruments (see section on care of instruments) than to sterilize the genito-urinary tract. A good deal can be accomplished in that direction by irrigations of the bladder and urethra, before instrumentation, with oxycyanat-of-mercury solution, 1 to 4000.

The urine should be sterilized by the administration by the mouth of salol, gr. x, three times a day, or utropin, gr. vii, three times a day.

III. All instrumentation should be made with the utmost gentleness, to avoid causing lacerations. By avoiding any tearing of the mucous membrane there is no opportunity for micro-organisms to make their way into the blood-current and so excite the fever.

Treatment of the Attack.—As already stated, after the chill the fever subsides, when the patient breaks out into a profuse sweat, and the indication, therefore, is to encourage free perspiration by putting the patient to bed, surrounding him with hot bottles, and giving a hot drink.

Phenacetin is useful for the headache, and a saline cathartic should be given the next day to complete elimination of the toxin.

The *chronic form* of urinary fever is generally accompanied by cystitis, and here the indications are to secure free drainage of the bladder and keep it clean by frequent irrigations. If the inflammation has extended from the bladder upward through the ureters and involved the kidneys, the indication for treatment is to increase the reduced secretion of urine to the normal standard again by means of milk diet and large draughts of spring-water.

Salol and urotropin should be given as urinary antiseptics and small doses of quinine are useful as a tonic.

CARE OF URETHRAL INSTRUMENTS.

All the instruments which are used in the urethra should be perfectly smooth and highly polished, since any roughness upon the surface will abrade the delicate mucous membrane and expose the patient to the dangers of septic absorption and urinary fever. Instruments should also be well lubricated before introduction. Vaselin is most commonly employed, but it has the disadvantage of coating the mucous membrane and preventing its contact with the irrigating solutions used afterwards. Any lubricant should be kept in and used from the flexible tubes, which protect it from the air and keep it sterile.

An excellent lubricant is prepared according to the following formula, suggested by Casper:—

℞ Hydrarg. oxycyanat	Grms. 0.246	(gr. iiiss)
Glycerine	20.	(f℥ss)
Tragacanth	3.	(gr. xlvj)
Aq. destallat	100.	(f℥iij)

This should be put up in tubes and remains sterile.

It is a good lubricant for all urethral instruments, and may be used in preference to glycerine for lubricating the cystoscope before introduction, as it washes off the lamp and window after the cystoscope has entered the bladder.

It is unfortunately impossible to rid the urethra completely of organisms before introducing instruments, but a considerable amount of sterilization can be accomplished by irrigating the urethra with a 1 to 4000 oxycyanat-of-mercury solution before instrumentation. After the operation of passing sounds or using a cystoscope is finished, another irrigation of the urethra and bladder with oxycyanat should also be made. After a cystoscopy it is always useful to irrigate the bladder through a catheter with 1 to 1000 solution of nitrate of silver, to destroy any organisms which may have been accidentally introduced.

With regard to the care of the instruments themselves, several large books have been written on the best ways of sterilizing them, but for everyday practical use in the office or dispensary, the following methods, which are at present in use in the genito-urinary clinics in Berlin, will be found to meet the requirements.

Sounds and *urethroscopic tubes* should be kept in a drawer and prevented from knocking against each other, which destroys the polish. After using, they should be washed in hot water with soap and a brush, and boiled for five minutes in a solution of washing soda. (℥iiss to Oij). The soda is added to prevent rusting. Lithotrites, tunneled sounds, urethrotomes, and metal catheters may be treated in the same way. Soft-rubber catheters should be washed off outside and running water allowed to flow through them; but this is not enough for disinfection, and, in order to accomplish this, they must be boiled in plain water afterward.

Cystoscopes cannot be boiled, as the cement holding the lamp in place is destroyed; but, according to Casper, they may be completely sterilized by rubbing for two minutes with two or three cloths wet with tincture of green soap, paying particular attention to the joints about the lamp and prism. They should be rubbed afterwards with alcohol, to remove the green soap.

The movable parts of the catheterizing cystoscope may be boiled for five minutes.

Before using they may be immersed for a few minutes in solution of formalin 2½ per cent., or in lysol.

Silk-web catheters, urethral or ureteral, after being used in cases which are not very septic, should be rubbed outside with alcohol and ether, or benzine, to remove the adherent lubricant or secretions, and washed with soap and water. The lumen should be treated by syringing through with oxycyanat of mercury 1 to 4000 and then hung up all night to drain and dry. In the morning they should be placed in a jar containing a formalin tablet.

The woven-silk catheters which were formerly made were spoiled by boiling, but improvements in the manufacture now make it possible to boil them twenty or thirty times before they become too soft to use.

Catheters which were used in very septic cases should be sterilized by wrapping each one separately in gauze, and boiling three minutes in a saturated solution of ammonium sulphate, not allowing them to come in contact with each other or the bottom of the vessel. After boiling they should be taken out and laid away to cool off and become hard.

Instead of being boiled in sulphate-of-ammonium solution, they last longer if they are treated by wrapping in gauze separately and placed in the boiler above the level of the water and steamed for five minutes.

In a clinic where many catheters are used, they can be sterilized in quantities, by placing them in the steam sterilizer, which is a part of the outfit of every hospital operating room, and after steaming they can be laid away, wrapped up in filter-paper and ready for use.

Flexible bougies à boule, after using, should be washed off with soap and water, or rubbed off with benzine or alcohol ether, sterilized by rubbing off with oxycyanat solution, and laid on a cloth for some hours to become thoroughly dry.

They may also be steamed five minutes, but become softened in time.

They should be kept in a jar containing a formalin tablet.

Kollmann's irrigating dilators, after using, are washed off with soap and water and a brush, and steamed in a special steam pot, or boiled for five minutes and then dipped in alcohol to prevent the joints from rusting.

Rubber dilator covers are rubbed off with benzine or alcohol ether to remove the grease, then wrapped in gauze and steamed for five minutes. If placed in the boiler they should be kept above the water level, as boiling softens them.

Glass irrigator nozzles should be boiled and kept immersed in solution of oxycyanat of mercury.

Knives with fine, delicate edges are dulled by boiling, but may be sterilized by placing in alcohol or formalin solution 2½ per cent.

Whalebone guides are spoiled by boiling or soaking in a solution. After using, they should be rubbed off with benzine or alcohol ether and oxycyanat solution, and kept in a jar containing a formalin tablet.

DISEASES OF THE BLADDER.

CHAPTER XI.

CYSTITIS.

ETIOLOGY.

It is an event of great rarity for a perfectly normal bladder to become the seat of inflammation, while, on the other hand, any non-inflammatory affection of this organ is most apt to become complicated, sooner or later, by the element of germ-infection, with inflammation ensuing.

There are numerous conditions which may act as **predisposing causes** to cystitis, although they may exist indefinitely without actually causing inflammation. The one most frequently met with in practice is the retention of *residual urine,* occurring in cases of stricture and enlarged prostate or resulting from paralysis of the nerve-supply to the bladder, depending upon a fractured spine or a myelitis. Retention of urine in itself cannot cause inflammation so long as the bladder remains free from infection with micro-organisms; but stagnant urine affords an excellent culture medium for the growth and development of germs which may be introduced into the bladder, and the retention of urine, if long continued, impairs the vitality of the mucous membrane by keeping it congested.

Chronic congestion of the mucous membrane may occur without the presence of retained urine, and may be occasioned by calculus, some forms of prostatic enlargement, and in women by pregnancy and menstruation.

The normal epithelium of the bladder offers a barrier to the penetration of micro-organisms so long as its cells are intact; but if the bladder-walls are congested for some time, the superficial cells are loosened and desquamated and the softer cells underneath are exposed, allowing the entrance of germs.

The hyperæmia also causes the small blood-vessels to rupture, on account of the increased vascular pressure.

Exposure to cold is often considered an exciting cause of cystitis, but it can only act in an indirect way by lowering the vitality of the tissues, so that germ-infection may the more easily take place.

The various predisposing causes above mentioned cannot in themselves excite inflammation. They operate by preventing the bladder from being evacuated, and allowing residual urine to accumulate and form a favorable culture-medium for germs, or by producing congestion of the mucous membrane, which lowers its vitality and causes desquamation of its protective cells, thus opening up avenues for infection.

The exciting cause of an attack of cystitis is invariably **micro-organisms.** Normal urine is an aseptic fluid, free from germs, and can be injected into the peritoneal cavity without causing suppuration. In every case of cystitis various forms of cocci and bacteria are always present.

Many of these organisms are incapable of causing cystitis, if they find their way into a normal bladder, which can be completely emptied of its urine, because they are voided along with the urine, without causing any injury to the bladder.

On the other hand, the Staphylococcus Pyogenes and the Uro-Bacillus Liquefaciens Septicus and virulent cultures of the Bacillus Coli possess the power of breaking up urea and forming ammonia, and on this account they are able in themselves, without the aid of a favorable predisposing cause, to excite cystitis.

Micro-organisms Found in Cystitis.—C. Mansell Moullin[1] examined the urine from 30 cases of suppurative cystitis, most of which were old men with enlarged prostates. Cases of tubercular and gonorrhœal cystitis were excluded, and the following results were obtained:—

The reaction was acid or neutral in 24 and alkaline in 6.

Micro-organisms were present in abundance in all of them.

The Bacillus Coli was present in 21 of the acid urines and in 4 of the alkaline cases.

Streptococcus Pyogenes occurred in 4 acid and 3 alkaline cases.

The Urobacillus Liquefaciens was present in 5 of the alkaline cases.

In addition a Staphylococcus was present in 8 and a Diplococcus in 2.

These examinations show that the Bacillus Coli is the organism most frequently present in cystitis when the urine is acid, and the Urobacillus Liquefaciens Septicus when it is alkaline.

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[1] "Inflammation of the Bladder and Urinary Fever," Blakiston, 1898.

Bacillus coli in shape is a short bacillus with rounded ends, which is found normally in the intestinal canal. The virulence of its culture depends upon the source from which they are taken, a growth from the contents of the healthy intestine having less virulence than one taken from a case of infantile diarrhœa, while a culture from choleraic discharges is virulent in the highest degree.

Unlike other micro-organisms, the bacillus coli has but little effect in causing the urine to become alkaline by decomposing its urea, and the urine retains its acid reaction for a considerable length of time. Although the bacillus coli is a harmless saprophyte in the intestine, it has the effect, when injected into the tissues, of causing an abscess or of inducing toxæmia or general septicæmia.

The Urobacillus Liquefaciens Septicus is chiefly of interest from its power of decomposing urea and causing the urine to become alkaline within a few hours.

Cultures of the Bacillus Coli, if injected into the bladder, often fail to produce cystitis unless a predisposing cause, such as retention of urine or congestion, be present.

If, however, the Urobacillus gains admission to the bladder, cystitis almost invariably follows on account of the ammonia which is set free from the decomposed urea and which acts as an exciting cause for the inflammation.

The Streptococcus Pyogenes and Staphylococcus Pyogenes Aureus are both capable of inducing septicæmia if they gain entrance into the blood-circulation, and locally they attack the bladder-walls. causing diffuse inflammation with suppuration.

The Streptococcus does not decompose urea, and when it is found in alkaline urine the decomposition has been effected through the agency of another micro-organism, which is often the Urobacillus.

Experimental and clinical evidence serves to show that, while all cases of ordinary suppurative cystitis are dependent upon these or similar organisms, inflammation of the bladder cannot be induced by their mere introduction into it, so long as the urine can be completely evacuated and its walls are in a healthy condition. The Urobacillus Liquefaciens alone is capable of exciting cystitis in a normal bladder, through its property of decomposing urea.

If, however, there be residual urine retained in the bladder, behind a stricture or enlarged prostate, or if the bladder-wall is congested and eroded from the irritation of a calculus or the administration of cantharides, cystitis will surely result from the introduction of the other forms of micro-organisms.

Avenues Through which Micro-organisms Reach the Bladder:— Germs may enter the bladder by the following routes:—

I. Through the urethra.

II. They may descend with the urine from the kidneys.

III. They may pass through the blood-circulation direct to the bladder.

IV. They may pass through the lymphatics from adjacent organs.

I. Infection through the Urethra.—As already stated the Bacillus Coli is responsible for the larger number of cases of cystitis. Its chief habitat is the intestine, where it is always present, although varying greatly in virulence. It is also usually to be found, but mixed with other organisms, upon the glans penis, and under the prepuce and in the fossa navicularis, and in women it exists in the meatus urinarius and the folds of the vulva.

The deep urethra in the male probably does not afford a resting-place for germs while it is healthy. When, however, it is altered by disease, either stricture or enlargement of the prostate, the dilated pouch, containing stagnant urine and mucus, affords a favorable hibernating-place for bacteria.

Cystitis does not occur in men with healthy urethras, except as a result of instrumentation, but in cases of enlarged prostate it is of common occurrence, even when no instruments have been used. In most instances where the bladder is infected from the urethra a catheter or sound is the means by which the germs are introduced.

Although the instrument may have been sterile before introduction, it may have been infected by brushing against the patient's clothing, or acquired germs from contact with the glans penis or meatus, or it may have carried germs along from a pouch behind a stricture or enlarged prostate in the urethra itself.

But, unless the predisposing causes of congestion of the bladder-wall or residual urine be present, the micro-organisms will usually be swept out of the bladder with the first act of urination, without causing any damage.

II. Infection of the Bladder with bacteria which descend in the urine from the Kidneys.—The bacillus coli, which exists in profusion in the intestinal canal, readily makes its way through the wall of the intestine into the blood-circulation, and notably so, if diarrhœa or intestinal disease be present. After gaining the blood-circulation the bacilli are eliminated by the kidneys, and passing out with the urine gain entrance to the bladder, and under the existence of favoring conditions, such as congestion or residual urine, cystitis is excited.

III. Infection of the Bladder through the blood current.—Infective emboli occurring in the course of some general disease may be carried through the capillaries, and local foci of disease in the bladder may be originated through their agency. This cause of infection, however, seldom occurs except as a result of tuberculosis.

IV. Micro-organisms formed in an adjacent organ may be carried to the Bladder through the channel of the lymphatic Vessels.—This form of infection has been proved experimentally and will serve to explain the occurrence of cystitis in women who are the subjects of salpingitis and endometritis and in whom the micro-organisms probably pass from the ovaries or uterus to the bladder, through the lymphatics.

CLASSIFICATION.

Cystitis begins acutely, and frequently becomes chronic. Various attempts to group the varieties from an etiological or anatomical standpoint have been made, but for practical uses a division into *simple, suppurative,* and *specific* cystitis serves the purpose.

Under the term **simple cystitis** is understood the inflammation of the bladder which is not caused by germ-infection, but which results from a mechanical cause, such as the irritation from a calculus or crystals in the urine or from a chemical irritation caused by cantharides. Simple cystitis exists as a theoretical condition only, for, as a matter of fact, the complication of *germ-infection* occurs in every case, and in a few hours the bladder becomes infected with micro-organisms, and the simple inflammation is converted into **suppurative cystitis.**

PATHOLOGICAL CHANGES IN THE BLADDER.

Location.—The disease process is most marked in the region of the trigone and particularly so around the ureters and urethral orifice. The fundus is usually nearly or quite normal.

The mucous membrane is the part usually affected, but the inflammation may attack the deeper structures and the muscular, subserous, and even the serous coats may be involved.

In acute cystitis the cystoscope affords a means of studying the changes in the mucous membrane of the bladder. Its color is found to be brilliant scarlet, with branching lines marking the course of the distended vessels, which bleed readily. The surface of the mucous membrane has lost its polish, is ragged and velvety, and has flakes of lymph adhering to it. In severe cases the epithelium is detached, leaving *erosions*.

In very septic cases portions of the mucous membrane slough away, and hang from the walls in shreds, and minute abscesses may form in the submucous coat or among the muscular layers. Micro-organisms are invariably present; the urine is filled with them and they lie on the surface and between the epithelial cells.

The **pathological changes in chronic cystitis** resemble those of the acute form, but are more marked. The erosions are deeper, sometimes forming actual ulcers. The surface of the mucous membrane is black or slate-colored, from the escape of blood-pigment into the tissues through small capillary ruptures.

In the early stages the muscular coat may undergo a true hypertrophy of its fibres, but, as a rule, the prolonged inflammation and the vascular degeneration lead in time to a condition of fibroid induration and sclerosis of the bladder-wall. The walls are thicker and denser than normal and their elasticity is entirely lost. As a result of those conditions the cavity of the bladder often becomes so small and contracted that it can only hold a few ounces. The bladder-wall on contracting falls into folds, with spaces between them, from which it is difficult to empty the urine even with a catheter.

In time the spaces become stretched, forming **sac-like dilatations,** which may be as large as the bladder itself.

These sacs are only covered by serous membrane, and have no muscular fibres; so that they cannot empty themselves of their contained urine, and being filled with stagnant decomposing urine, they become a favorite seat for stone-formation.

On the other hand, the bladder-walls, instead of being hard and fibrous around a small contracted cavity, may become thin and flaccid, and the cavity may be distended to a capacity of a quart or more.

Membranous Cystitis.—As a result of intense septic infection of the bladder, combined with pressure on its blood-vessels, sufficient to shut off the circulation and cause gangrene, a false membrane may form within the bladder, which is thrown off as a coat of its walls.

The microscope shows these coats to be composed of epithelial cells, lymph, urinary salts, and micro-organisms entangled together.

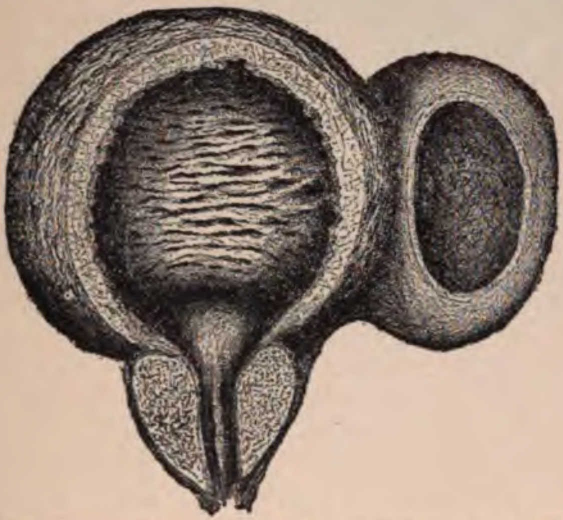


Fig. 75.—Formation of a sacculation in a hypertrophied bladder from prostatic enlargement and prolonged cystitis.

The slough may make its exit through the urethra, or the whole thickness of the bladder-wall may slough into the cavity of the abdomen.

SYMPTOMS.

Local Symptoms.

I. Frequent Urination.—The inflamed and irritable condition of the bladder-walls and posterior urethra renders the bladder very intolerant of any tension and after a small quantity of urine collects it is expelled. Prolonged standing or jolting increases the desire to urinate in cystitis and particularly so when the inflammation depends upon a vesical calculus.

II. Painful Urination.—In acute cases the pain is more or less constantly present over the bladder, and is aggravated by the act of urination. As the desire to urinate comes on, the pain increases, and as the bladder contracts the pain may be agonizing, and is felt in the bladder and rectum, and radiates to the end of the penis and down the thighs.

In severe cases there is a desire to urinate every few minutes, and the act of urination is accompanied by great straining or tenesmus.

In the presence of stone or posterior urethritis of gonorrhœal origin, the pain is increased after the act of urination, on account of the inflamed walls of the bladder being squeezed together by the muscular contractions. Strangury is noted in the most severe cases only, in which the pain is continuous and where the patient makes violent and straining efforts to urinate and only expels a few drops of blood-stained urine each time.

In chronic cases but little pain is experienced, except in the instances of enlarged prostate, when the bladder is hypertrophied and very much contracted.

III. Pyuria.—Pus in the urine is a constant occurrence in every case of cystitis. If the urine is acid in reaction, the pus appears as a cloud distributed through the urine; but if the reaction is alkaline and ammoniacal, the pus is coagulated and takes the form of a viscid, tenacious, ropy mass, at the bottom of the vessel.

IV. Hæmaturia.—A slight amount of bleeding occurs from a rupture of the congested capillaries in the bladder-walls, in all cases of cystitis. The blood is always intimately mixed with the urine and disseminated through it. A gush of pure blood following the act of urination is a characteristic sign of inflammation of the posterior urethra.

Constitutional Symptoms.

The constitutional symptoms in cystitis are caused by the toxins which are absorbed into the circulation, and their severity depends upon, first the amount of the poison absorbed, and secondly, upon the rapidity of its absorption.

If the bladder is able to empty itself thoroughly, absorption does not take place to any great extent and the constitutional disturbance is not marked.

If, on the other hand, the bladder cannot evacuate itself completely, or if pyogenic organisms have invaded its walls, severe constitutional disturbance follows.

In acute cystitis the bladder can usually empty itself, and the temperature is not high and the constitutional symptoms are not particularly marked; but if, from some cause, obstruction to the outflow of urine exists, and the protecting epithelium has been desquamated from the bladder-wall, an opportunity for the absorption of toxins is afforded and the constitutional symptoms are grave.

This is particularly true in cases of mixed infection, in which the bacillus coli is associated with the urobacillus liquefaciens septicus or staphylococcus pyogenes.

The ammonia which is formed from the decomposed urea, helps to break down the protecting layer of bladder epithelium, and the erosions thus formed allow large quantities of toxins to pass rapidly into the blood-circulation.

In old men at the beginning of catheter-life, an asthenic form of cystitis is not uncommon. It is always associated with chronic urinary fever and is often fatal.

In chronic cystitis the constitutional disturbance is slight, because there is very little absorption of toxins from the bladder. Grave symptoms occur only when an acute attack is ingrafted upon a bladder which has suffered with chronic inflammation. Some organism which is capable of decomposing urea enters and ammonia is formed. The tissues, altered by long-continued inflammation, respond violently to the irritant, the kidneys become involved, and septic poisoning follows.

DIAGNOSIS.

The symptoms of frequent urination and pain, when accompanied by turbidity of the urine with pus and occasionally blood, are very characteristic of cystitis. The presence of pus or blood in the urine, however, only signifies that there is a condition of suppuration somewhere along the genito-urinary tract. In chronic cases of cystitis it is always important to exclude such local conditions as stricture, stone, or enlarged prostate, and in acute cases the absence of gonorrhœal or tubercular infection should be ascertained and the state of the prostate and seminal vesicles should always be examined.

The use of the *cystoscope* is not admissible in acute cases, on account of its increasing the existing irritation, but in chronic cystitis it is indispensable. By its means it is possible to exclude malignant disease and tuberculosis of the bladder and calculus, and the presence or absence of an enlarged and projecting middle lobe of the prostate can be readily ascertained.

Pyelitis can at the same time be diagnosed or excluded, sometimes from the appearance of the ureteral openings, but with absolute certainty by catheterizing the ureters.

The *microscopic* examination is almost as important, to determine the character of the micro-organisms, the variety of the urinary crystals, and the form of the epithelial cells, from which some conclusion as to the involvement of the kidneys may be drawn.

PROGNOSIS.

Acute cystitis may heal completely or it may become chronic.

The cure of chronic cystitis depends entirely upon its causation. When it is due to stone, stricture, or enlarged prostate, and its cause can be removed by surgical interference, the prognosis is good.

Chronic cystitis in itself rarely causes death except in the aged and debilitated, who die from absorption of toxins and urinary fever; but, if inflammation of the bladder continues for some time, the infection travels up the ureters, and the kidneys become the seat of disease which ultimately proves fatal.

PREVENTIVE TREATMENT.

Suppurative cystitis is always caused by micro-organisms, of which the most common form is the Bacillus Coli Communis, which originates in the intestine and may make its way into the bladder through the urethra, general blood-circulation, or lymphatics.

Under ordinary conditions the Bacillus Coli is a harmless saprophyte, but diarrhœa, constipation, and other intestinal disorders convert it into an extremely virulent pyogenic germ. Hence it follows that the intestinal canal should be kept as aseptic as possible by means of calomel, purgatives, and intestinal antiseptics. Local foci of infection, where germs can grow in the urethra and around the external genitals of the male and female, should be kept clean and aseptic.

As long as the mucous membrane lining the bladder remains unbroken and the organ is capable of being completely emptied of its contained urine, bacteria may be introduced into the bladder without harm, as they are soon flushed out by the stream of urine, and cystitis can rarely be induced unless the bladder-wall has been congested and the epithelial lining eroded or it contains residual urine, caused by an enlarged prostate, stricture, or vesical atony. On this account it is important to attend to any local diseased conditions which interfere with its proper emptying, and allow residual urine to accumulate or the bladder-walls to become congested and eroded.

Catheters and sounds must be sterile before using, and the external genitals should always be cleansed before instrumentation (see section on asepsis of instruments).

GENERAL TREATMENT OF ACUTE CYSTITIS.

In all but the mildest cases, the patient should be kept in bed until the severity of the symptoms is controlled and the acute stage is past.

The room should be maintained at an even temperature, for the congestion of an inflamed bladder is notably increased by chilling the surface of the body and by the muscular efforts of walking.

Purgatives.—A brisk calomel purge should always be administered at the beginning of an attack, for the purpose of clearing out the intestine, which is the main source from which the bacillus coli is derived. It has been shown experimentally that rectal obstruction is almost immediately followed by the appearance of enormous numbers of colon bacilli, which come either from the kidneys or directly from the rectum to the bladder through the thin intervening walls. During the progress of the case a daily movement of the bowels should be secured by Hunyadi or Rubinat water.

Hot sitz-baths at a temperature of 100° or 105° F. are serviceable in allaying the vesical irritability and tenesmus. The exposed part of the patient's body should be well covered with blankets while taking them.

The diet should be light and largely composed of milk. Meat should not be allowed at all or only in small quantities. Fresh fruit may be taken in moderation. Alcohol is interdicted unless perhaps in old men who need a stimulant, in which case whisky well diluted may be used.

Diluents.—Pure spring-water or distilled water may be taken freely, unless the desire to urinate is very frequent and urgent. The various infusions of triticum, buchu, etc., probably render the urine bland, simply through the water they contain. Alkalies should never be administered as a routine measure, since in cystitis the urine is frequently alkaline from decomposition of urea into ammonia or from a fixed alkali, and the internal use of alkalies does harm by increasing the alkalinity. If the urine is highly acid and deposits uric-acid crystals, bicarbonate or citrate of potash is useful in allaying the irritation.

Opium is often required in acute cases to control the vesical tenesmus, pain, and irritability. It is given preferably in ½-grain morphia suppositories, but may be used by the mouth as well. It is unwise to inject morphia into the bladder. If the bladder mucous membrane is unbroken, it will not be absorbed, and, if erosions are present, absorption may occur too quickly, and give rise to symptoms of poisoning.

The same holds true of **cocaine**, which has little or no effect in causing local anæsthesia of the bladder, as it does in other mucous membranes, and has the great disadvantage of very materially increasing the congestion of the mucous membrane, at times sufficiently to cause retention of urine.

Balsams.—Sandal-wood oil has a very beneficial action in allaying the too frequent urination and pain of cystitis, in its acute stage. Later in the attack, when the secretion of pus has diminished so that the urine, instead of being turbid, presents only a fine cloudiness, the oleoresins, such as turpentine, copaiba, cubebs, and fluid extract of pichi, and minute doses of cantharidin dissolved in alcohol, have an effect in quickly causing a cessation of the suppuration and a clearing up of the urine.

Urinary Antiseptics.—The antiseptics are supposed, through their germicidal properties, to destroy the inflammatory process at its root. Salol may be considered as a representative of the group. It is given in doses of gr. x three times a day, and acts promptly as a destroyer of micro-organisms, through the constituent carbolic acid, which, from its decomposition, is set free in the urine. In the same way boric and benzoic acids, in doses of 20 grains per day, exercise their germicidal power, and are to be chosen when the urine is alkaline in reaction from the presence of a fixed alkali.

In the group of aniline derivatives may be mentioned methyl-blue and Urotropin. Methyl-blue, first recommended by Einhorn, in the quantity of 15 grains a day in tablets or capsules, is often of service when the urine contains large quantities of bacteria. The urine, from using this drug, becomes greenish at first in color and later of an intense blue. Urotropin, which dissolves phosphatic concretions and causes phosphaturia to disappear with rapidity and often permanently, in many cases, has proved to be a urinary antiseptic of great value.

and particularly so in cases of chronic cystitis accompanied by ammoniacal decomposition of urine. It does not destroy the micro-organisms, but prevents their growth and development. The proper dose is 24 grains per day; if this is exceeded, burning in the urethra and frequent urination occur.

LOCAL TREATMENT OF ACUTE CYSTITIS.

Bladder-washing, which is so essential in chronic cases, is entirely inadmissible in the acute forms. The only varieties of local application which can be used without doing harm are:—

Instillations of Nitrate of Silver.—These can be used with advantage in the most acute cases of cystitis. The principal indications for their use are painful and frequent urination, provided the bladder is capable of emptying itself. By means of an Ultzmann syringe 20 drops of nitrate-of-silver solution, increasing in strength from gr. j to gr. x, are deposited every second or third day in the posterior urethra, from which point it flows back into the bladder and trickles over the surface of the trigone, which, together with the posterior urethra, are the parts most involved in the inflammatory process. The bladder should be empty, before the instillation, as the nitrate of silver is neutralized if it comes in contact with urine. Instillations are mainly useful in acute cases, although sometimes of service in chronic cystitis.

GENERAL TREATMENT OF CHRONIC CYSTITIS.

After the severe pain and frequent urination of the acute stage have passed off, the urine still contains pus in large quantities and has to be voided more frequently than in the normal condition.

The patient should no longer be confined to bed, but should have the benefit of the fresh air, although much walking is, of course, out of the question for him. He should be instructed to clothe the body in flannel, to wear woolen stockings, and India rubbers in damp weather, and cautioned particularly to avoid exposure to a draft or dampness.

The sandal-wood oil is of less use in chronic cases than in the acute, but the oleoresins are of value; and the urinary antiseptics, Urotropin and salol, have here their field of greatest usefulness. By means of the general treatment but little can be accomplished, and the main reliance is the local treatment.

LOCAL TREATMENT OF CHRONIC CYSTITIS.

Indications.—I. *Remove any local source of irritation within the bladder or any obstacle to its evacuation.* Palliative measures for the cure of cystitis are of no avail if a calculus or tumor be allowed to remain within the bladder, or a stricture or enlarged prostate causes residual urine to accumulate.

Indication II. *Remove the urine from the bladder and keep it empty.*

In cystitis, if the bladder is able to empty itself completely, the micro-organisms are soon swept away and the attack is over; but, if residual urine is allowed to remain and become stagnant, it affords an excellent culture-medium for the growth of the germs.

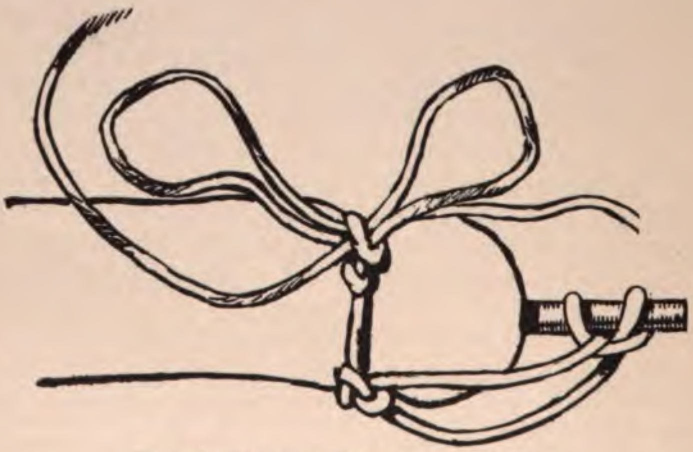


Fig. 76.—Tying Catheter in the Bladder.

The simplest form of drainage of the bladder is by means of a soft-rubber catheter passed once a day or oftener, as needed; but in atonic bladders, or severe cases, this is not sufficient and the bladder *must be kept empty.*

Permanent catheterization may be employed by passing a catheter into the bladder through the urethra and tying it in, so that the urine is voided as fast as it is secreted by the kidneys. The disadvantages of this method are that after a few days it is apt to excite inflammation of the urethra, epididymitis, urinary fever, or suppression of urine. In consequence of these drawbacks, except in very light cases of cystitis or in the presence of debility which is so great that there is danger in giving an anæsthetic, it is best to drain the bladder through a perineal or suprapubic incision.

Perineal Drainage.—*Technique of Operation.*—A lithotomy-staff is introduced into the bladder through the urethra and an incision is made through the perineum, into the membranous urethra, by thrusting a long, straight bistoury an inch and a half in front of the anus, until its point strikes the groove in the staff. A gorget is introduced into the bladder through the wound and a No. 30 French, soft-rubber catheter carried along it, till its eye lies within the cavity of the bladder.

A silk suture is then passed through the skin of the perineal wound and the catheter, in this way keeping the catheter from being forced out by the contractions of the bladder.

Instead of a rubber catheter, Watson's silver perineal drainage-tube may be used in cases where the bladder is tolerant; but the metal tube is apt to excite more pain than the soft-rubber catheter.

The catheter is attached to a rubber tube whose end lies in a bottle on the floor to receive the urine. In this way the bladder is kept entirely empty, and can be thoroughly cleansed by irrigations.

The length of time during which the drainage is to be maintained varies greatly, depending upon the degree of the cystitis. It should be continued until the urine is free from pus and acid in reaction and the muscular walls of the bladder have regained their tone, and this, in a severe case of long standing, may require some months.

Suprapubic drainage is to be preferred to drainage through the perineum, when it is continued for some length of time, as the flow of urine through the abdominal fistula can be received in a rubber bag under the patient's clothing (the Bloodgood bladder-drain) and he can go about and keeep dry.

The operative treatment is resorted to only in particularly severe cases, which on account of extreme tenderness make all local means of treatment impossible. Such instances occur in patients with contracted bladders and but little residual urine. They suffer from constant pain and frequent and painful urination, with the discharge of a few drops of ammoniacal urine each time. Again, in inveterate cases of chronic cystitis, where the bladder is atonic and perhaps sacculated, and where bladder-washing and instillations have been used without effect, permanent drainage through a fistula often causes a marked improvement.

CURETTAGE OF THE BLADDER.

In recent years the fungosities have been removed from the bladder-wall by means of a sharp curette introduced through a perineal or suprapubic incision, and in some cases it has seemed to be of benefit.

It can readily be performed without any risk at the time the bladder is opened for the purpose of prolonged drainage.

Indication III. *Destroy micro-organisms or check their growth and remove pus and fermentation products from the bladder by means of irrigation of the bladder.* Washing the bladder is the most efficient mode of cleansing the bladder-walls of adherent pus, micro-organisms, and urinary salts. The micro-organisms which lie beneath the mucous membrane cannot be reached, but, by lessening the congestion of the mucous membrane and removing decomposed urine, it is put in a condition which favors its recovery.

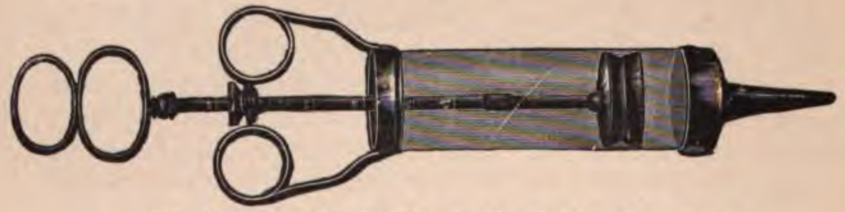


Fig. 77.—Janet-Frank Syringe (Kny-Scherer Company.)

Although the bladder can be filled by hydrostatic pressure from an irrigator, it requires a catheter to wash it out. The only suitable forms of catheter are the soft rubber and the gum elastic. They should be of large size and provided with two eyes, as the stream flowing through them stirs up the stagnant urine more effectually if it enters the bladder from two directions.

A large glass-and-metal syringe holding five ounces may be used, and has the advantage that it is possible to judge of the extent to which the bladder is filled by the feeling of resistance, to the inflowing stream, offered by the muscular walls of the bladder. The successive jets entering also set up contractions of the muscular walls, which have an influence in restoring their tone, and the introduction of fluid in this manner also forms rapid currents in the bladder which effectually cleanse its walls from adherent pus.

The general custom is to use an *irrigator* raised to the height of two to four feet and attached to the catheter by a short glass connecting-tube. The patient should rest upon a table or sofa in a half-sitting position, and the anterior urethra should be irrigated to cleanse it, before the catheter is carried into the bladder.

As soon as a sense of resistance is perceived or the patient feels pain, the inflow should be stopped, and after a short pause the fluid be allowed to flow out again, and the proceeding repeated until the solution comes away clear. The amount of fluid necessary to flow in at one time is small: 60 to 150 grammes (from 2 to 5 ounces) is enough.

Reginald Harrison and others state that it is impossible to cleanse the bladder in this way, and strongly advise the piston syringe as the only proper method of bladder-washing.

SOLUTIONS FOR WASHING THE BLADDER.

For simply cleansing the walls of the bladder and removing adherent pus and decomposing urine, normal salt solution, 0.6 per cent., or boric-acid water, 4 per cent., in strength, are well adapted to the purpose. Salicylic acid, 3 parts to 1000, has some effect in checking the fermentation process.

On account of the bacterial origin of the cystitis, many various antiseptics have been recommended, but on more extended trials they have proved disappointing and have fallen into disuse.

Nitrate of silver is an exception to the antiseptics just mentioned, and is the most valuable remedy we possess in suppurative cystitis. It should be used in the strength of 1-4000 up to 1-1000, beginning with the weaker and gradually increasing. The solution should be retained in the bladder two or three minutes and then allowed to flow out again. If much pain is caused it may be neutralized by washing afterward with salt solution. The application should be made every two to three days. Permanganate of potash or oxycyanat of mercury is less useful than nitrate of silver in cystitis, but is occasionally of service.

In chronic cystitis, when the bladder is contracted and much pain is complained of, the distension attendant upon washing the bladder contra-indicates its use, and instillations of nitrate of silver have to be substituted. Twenty drops may be used every two to four days, from gr. v to x in strength.

SPECIFIC CYSTITIS.

GONORRHŒAL CYSTITIS.

Statistics show that the posterior urethra is involved in 80 per cent. of the cases of gonorrhœa, but a true cystitis arising from infection of the bladder mucous membrane with gonococci is extremely rare, although a few cases have been recorded.

Inflammation of the trigone of the bladder frequently occurs during the course of a gonorrhœa, after the posterior urethra has been attacked, and is almost always due, not to the entrance of the gonococci into the bladder, but of some other pathogenic organism, and the infection is therefore of the mixed variety.

Its symptoms, course, and treatment are those of the ordinary forms of suppurative cystitis, and have already been discussed under that heading.

TUBERCULOUS CYSTITIS.

Tubercular involvement of the bladder occurs most frequently in young adults between the ages of fifteen and forty, although no age is exempt.

MODES OF INFECTION.

Primary infection of the bladder is of rare occurrence, although it is met with occasionally, for, so long as the vesical epithelium is intact, it affords an efficient barrier to the entrance into the tissues of any tubercle bacilli which may have found their way into the bladder. If the mucous membrane has been injured or eroded by the action of ammoniacal urine, the tubercle bacilli can easily enter the tissues. For this reason primary tuberculosis of the bladder is rare, and when a bladder becomes tuberculous it is usually infected from a deposit elsewhere.

Secondary infection of the bladder may result from the direct extension of a tuberculous infiltration of the seminal vesicles or prostate or the bacilli may be conveyed by the lymphatics or blood-circulation from the kidneys or testicle. Most of the cases of bladder tuberculosis, however, originate from the mural transplantation of tubercle bacilli contained in the urine from a tubercular kidney.

PATHOLOGICAL CHANGES.

The tubercular deposit always begins around the vesico-urethral orifice and trigone or around the ureteral openings. The process does not last as long as pure tuberculosis, for it is soon complicated by infection with other micro-organisms, causing suppurative cystitis and ammoniacal decomposition of urine.

A *cystoscopic* examination made early in the case shows a few minute papules or pin-head-sized ulcerations, and later in the disease are to be seen irregular-shaped ulcerations covered with a deposit of urinary salts and sloughing material, and the base of the ulcer may be covered with fungating granulations, which bleed easily.

The walls of the bladder in some places become hard and rigid and in others are softened, and its capacity is diminished, so that it may only hold a few ounces of urine. The cellular tissue surrounding the base of the bladder becomes the seat of multiple abscesses, which break and form fistulæ.

SYMPTOMS AND COURSE.

Tuberculosis of the bladder begins insidiously, and often without any apparent cause. Its symptoms are those of cystitis, viz: frequent urination, pyuria, and hæmaturia. Bleeding is a prominent symptom, appears early in the disease, and is more or less persistent throughout its course.

In the later stages, after suppurative cystitis has made its appearance, the striking symptom is the painful and frequent urination, occasioned by the contraction of the walls of the bladder and the ammoniacal urine coming in contact with its ulcerated walls. The endeavor to rid the bladder of the irritating urine causes straining every few minutes, which is accompanied by intense pain. The kidneys are, after a time, infected, and become the seat of abscesses. Abscesses and fistulæ form around the base of the bladder, and the patient dies from exhaustion induced by the incessant pain and the septic fever.

DIAGNOSIS.

Tuberculosis should always be suspected when a young man of tuberculous heredity develops a cystitis without any apparent exciting or predisposing cause, which runs a very persistent and intractable course, and is not cured by the ordinary treatment.

The *cystoscope* should be used with extreme precautions, to avoid causing an infection of the bladder with pus-organisms. It may show tubercles in groups or disseminated, or ragged, punched-out, irregular ulcers.

A *microscopic* examination of the pus from the bladder confirms the diagnosis by disclosing tubercle bacilli. There may be difficulty in finding the bacilli, even after centrifugating, as they are often scanty. If none are found, the sediment may be injected into the subcutaneous tissues over the abdomen of a guinea-pig. If the animal is killed four weeks later, and the lymph-glands are tubercular or tubercular nodules are disseminated throughout the body, the diagnosis is established.

A careful search should always be made for tubercular foci in neighboring organs, and nodules may usually be found in the prostate, seminal vesicles, or epididymis.

Tubercular involvement of the kidney often exists and is overlooked. The symptoms are not marked; there is an absence of renal pain and colic and no tenderness on pressure. It may be suspected, however, when the urine is persistently of a low specific gravity and acid in reaction, and when the pyuria is intermittent in character, and the amount of pus is greater than could be furnished by ulcers in the bladder.

If the cystoscope shows a tubercular ulceration about the mouth of one ureter, it is an evidence that the kidney on that side is affected; but the point can only be definitely determined by catheterizing the ureters or making use of Harris's rectal segregator and examining separately the urine from each kidney.

PROGNOSIS.

The prognosis in tuberculosis of the bladder is always grave, and recovery is exceedingly rare, but the disease may remain latent for years unless complicated by infection with pyogenic micro-organisms. This hastens the process; the kidneys are liable to become tubercular, and the bladder grows rapidly worse.

TREATMENT.

The attempt has been made by Guyon, Reverdin, and others to cure vesical tuberculosis in its earliest stages by opening the bladder above the pubes and curetting out the ulcers.

The resort to surgical measures in the beginning of tuberculosis of the bladder in the hope of curing the disease, is to-day practically abandoned. The bladder infection is almost always secondary to tubercular deposits in other organs, most frequently the kidneys, and surgical interference in the majority of cases only increases the rapidity of the course of the disease.

In incipient tuberculosis of the bladder, the indication for treatment consists in improving the vitality of the tissues, and to this end life in the open air or a long sea-voyage is the best measure.

Under this *régime* patients often improve and a few recover. After suppurative cystitis and pyelitis have set in, no benefit is to be derived from leaving home.

Creasote and carbonate of guaiacol are recommended by some authorities, and by others are considered of no avail.

Local treatment is harmful, as a rule. The tubercular deposits cannot be reached, and there is danger, in bladder-washing and instillations, of introducing pus-organisms and causing suppurative cystitis. After this has occurred, the instillation of corrosive sublimate (Guyon), using 20 drops of 1 to 5000 solution and increasing up to 1 to 1000, is often of marked benefit. The reaction following is rather severe, and may last five to six days, and should be allowed to subside before repetition. After the reactive symptoms have passed away, the pain of urination is lessened and the intervals between the acts are prolonged.

Guaiacol in 10 per cent. strength, with the addition of 1 per cent. of iodoform, suspended in olive oil, ½ ounce of which is injected every two days into the bladder and allowed to remain in, sometimes controls vesical tenesmus and pain, and enables the patient to hold water for a longer time.

A watery suspension of Orthoform, gr. viij to ℥ss, injected into the bladder and held there as long as possible, often relieves the pain for two or three hours.

Nitrate-of-silver instillations are irritating, and aggravate the inflammation. This is so notably the case that a violent reaction following the use of nitrate of silver in a case of cystitis suggests that it is tubercular in origin.

Later in the disease, when the pain and frequency of urination become unbearable, morphia is the only means of relieving the suffering.

As time goes by and opium fails to control the tenesmus and frequent micturition, **permanent drainage of the bladder through a fistula** should be established. This is not successful in relieving the difficulty entirely, but it is the last resort for the relief of the intense suffering. The suprapubic opening is to be preferred, as the apparatus for receiving the urine can be more easily applied and the patient is not long confined to bed, but can be up and about.

At the time of operation the bladder may be inspected, and if a few isolated tubercular ulcers are found they can be removed with the curette or Paquelin cautery and iodoform rubbed into the spots.

The subsequent healing of the ulcers has a favorable influence upon the pain and tenesmus, and the permanent fistula in the bladder affords an opportunity for the complete and painless evacuation of ammoniacal urine and pus, and also admits of its cavity being kept clean by irrigations, and the congested mucous membrane can also be medicated by instillations of corrosive sublimate or nitrate of silver.

When the bladder cavity is very much contracted and its walls are thick and rigid, suprapubic cystotomy cannot be so readily performed, and permanent drainage through a fistula in the perineum has to be resorted to.

There is always the danger, in establishing an artificial fistula, that the wound itself may be infected and become the seat of a tubercular infiltration, increasing the extent and rapidity of the progress of the disease. The perineal wound is much more liable to infection than the suprapubic opening, and should only be used when the suprapubic fistula is impracticable.

BACTERIURIA.

This condition is characterized by the quantities of bacteria which are found growing in the urine, which is entirely free from pus. The mucous membrane of the bladder is perfectly healthy and the infection is confined to the urine alone.

On inspection the urine appears turbid and of a whitish-yellow color, and the odor is very disagreeable, resembling stale fish or fæculent material.

On centrifugating and examining the sediment microscopically, it is found to be composed of the bacillus coli communis in enormous quantities. Pus and epithelial cells exist in very small numbers.

It is often impossible to trace the manner in which the bacteria gain access to the bladder, although in most of the cases reported there has been a condition of hæmaturia, enlargement of the prostate requiring catheterization, stricture, or recent gonorrhœa, and in women a recent inflammation of the pelvic organs. It is therefore supposed that the bacteria enter the bladder (*a*) through the urethra, (*b*) with the urine from the kidneys, (*c*) from the general blood-current, or (*d*) from adjacent organs through the lymphatics, although their place of proliferation is not discoverable.

SYMPTOMS.

The symptoms of bacteriuria are not marked, and the turbid urine with a foul odor is often the only sign.

Sometimes the urination is frequent and urgent, and accompanied by a burning pain in the urethra, and rarely a chill followed by fever, which resembles urinary fever in its onset and course, is noted.

COURSE.

The course of the disease is variable, occasionally brief and transient, sometimes more protracted, with remissions alternating with exacerbations, and it often becomes chronic, lasting for years.

PROGNOSIS.

The prognosis is rather unfavorable as regards a cure, unless the place of bacterial growth is accessible. If this is not the case, the bacteria are apt to remain permanently in the urine, but the general health does not suffer and the urinary organs remain in a healthy state.

DIAGNOSIS AND TREATMENT.

The diagnosis can only be made by excluding cystitis and finding the bacteria in the urine with the microscope.

The treatment consists in first removing any possible source of growth for the bacteria by relieving habitual constipation or enteritis. If the breeding-place of the micro-organisms is in some local condition, such as a posterior urethritis or stricture, it should be removed.

When no cause is discoverable, the administration of urinary antiseptics internally—salol, methyl-blue, and urotropin—in order to destroy the bacteria, is called for. The patient should drink freely of pure distilled or spring-water in order to mechanically wash out and remove the fermenting contents of the bladder.

Bladder-washing with solution of nitrate of silver or sublimate is, in general, of little use, and still at times it may be of some value, and oxycyanat-of-mercury 1 to 4000 irrigations may also be tried.

TUMORS OF THE BLADDER.

The new growths which occur in the bladder may be either **benign** or **malignant**. The benign tumors, or papillomata, appear in different forms: (*a*) As villous polypi, composed of loops of blood-vessels, which grow and project into the cavity of the bladder in long, waving strings, and (*b*) fibro-papillomata, which are pedunculated tumors of a firmer consistence.

Malignant Tumors.

Primary cancer of the bladder is exceedingly rare, but secondary deposits are not infrequent. The *forms* in which it presents are as

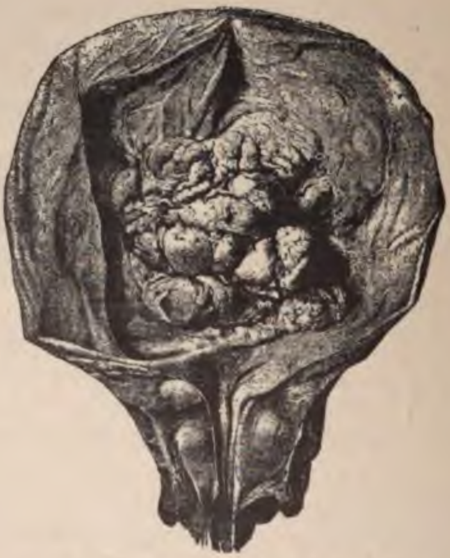


Fig. 78.—Carcinoma of the Bladder.

sarcoma or carcinoma, which is either epithelial or the glandular-celled variety.

They are less apt to be polypoid in appearance, but are spread out, *infiltrating* the tissues. The surface is covered with granulations or villosities, and in the later stages is ulcerated and presents gaping ulcers. The tumors are often multiple and their development is slow.

Both benign and malignant forms of growth are usually located in the region of the trigone or near the openings of the ureters.

Tumors of the bladder predispose to cystitis, which in time leads to disease of the kidney, either suppurative pyelitis or hydronephrosis, or death may occur from the constantly recurring hæmorrhages.

If cancer of the bladder is primary, it is not apt to affect the distant organs.

Vesical calculus is a frequent complication of new growths in the bladder from a deposit of the urinary salts upon the ulcerated bladder-wall or upon a piece of necrotic tissue separated by sloughing.

SYMPTOMS.

Hæmaturia is the most prominent symptom of tumor of the bladder. It comes on suddenly and without provocation, and may last a few hours or for some weeks. The quantity of blood lost is variable and fluctuating. At one time it may be abundant and upon the next urination the water may be almost clear.

Frequency of urination and tenesmus are often present in the later stages, and depend upon the cystitis, or are due to infiltration of the trigone and vesical neck by a malignant growth. Pain is never a prominent symptom, and when it occurs it is occasioned by the cystitis.

DIAGNOSIS.

The presence of a tumor due to malignant disease may often be felt by *palpation*, placing one finger in the rectum and making counter-pressure over the pubes with the other hand.

Any thickening of the trigone can be appreciated by introducing a sound into the bladder and feeling the thickness of the tissue which lies between the sound and the finger in the rectum.

Polypoid growths are not capable of being made out by palpation.

The cystoscope is not always available, on acount of the amount and rapidity of the hæmorrhage obscuring the medium; but when it is possible to use it a definite diagnosis of the conditions can be made by an experienced observer.

Cystotomy, either perineal or suprapubic, with digital exploration or inspection of the bladder, also affords a means of making a positive diagnosis.

The suprapubic opening is to be preferred, because if a tumor is present it can be removed more readily than through a perineal wound.

PROGNOSIS.

Benign tumors, if let alone, may cause death either from the repeated hæmorrhages or from pyelonephritis following cystitis. They can be readily removed by operation, but are apt to grow again.

Malignant tumors are difficult to remove completely, as they infiltrate the bladder-wall and are liable to recur. Authorities give the duration of life at from two to three years after the commencement of the disease.

In order to control the hæmorrhage it was formerly the custom to use hot injections of alum, ʒiv to the pint; fluid extract of hydrastis, ʒij to the pint; of acetanilid, ʒij to the pint. At present, the method of checking vesical hæmorrhage consists in administering Stypticin (Merck's), gr. iv. t.i.d. by mouth and injecting into the bladder a solution of suprarenal extract, 1 in 5000 to 1 in 1500.

Clots retained in the bladder, if moderate in size, may be left alone, as they will soften and be passed naturally.

If the bladder should become greatly distended by retention of urine, the clots may be withdrawn by a large catheter and suction syringe or a litholapaxy evacuating tube and aspirator.

If the bleeding continues and is persistent, suprapubic cystotomy should be performed without further delay. The suprapubic opening affords an opportunity for inspecting the interior of the bladder, and through it the tumor may be removed.

Polypoid growths are best treated by cutting through the mucous membrane at their bases, removing the whole tumor, and sewing up the incision with catgut sutures, or they may be removed by crushing or twisting off with forceps or by the sharp spoon, or they may be burned off with the Paquelin cautery or the galvano-caustic loop.

Infiltrating growths, which are always malignant, cannot be removed by these means, but require the complete extirpation of the portion of the bladder-wall upon which they are located.

If the tumor should be found too extensive for removal, the suprapubic opening should be maintained as a means of permanently draining the bladder of decomposing urine and blood-clots.

Certain cases of bladder tumors, where the growths are not very large or very numerous, and where they are located in an accessible part of the bladder, can be removed by using the Nitze operating cystoscope.

The tumor is brought into view with the cystoscope, surrounded by the sling, and its base burned through.

The base is subsequently cauterized, using the cautery attached to the cystoscope.

A very considerable amount of experience in the technique of cystoscopy, and particularly in the use of the operating cystoscope, is required to handle the instrument successfully; but by its use it is possible to remove many bladder tumors without making a cutting operation.

CHAPTER XII.

VESICAL CALCULUS.

THE stones which are formed in the bladder are classified, according to their composition, into three varieties:—

(a) Uratic calculi, which are made up of uric acid and urates. They form about three-fifths of the total number of calculi, and are the softest of any in their consistence.

(b) Oxalic calculi are composed of oxalate of lime. They occur less frequently than the others, the estimated proportion being about 3 per cent. They are the hardest and heaviest of all the varieties, and are usually studded with numerous projecting nodules, from which they derive the name of **mulberry calculi.**

(c) Phosphatic calculi are formed from phosphates and carbonates, which are often combined with urate of ammonia. Phosphatic stones are not so hard as the oxalic, but harder than the uratic stones. They are never due to constitutional or diathetic conditions, but are always the result of cystitis and decomposing urine, from which the salts are deposited and agglutinated together by the pus.

Stones composed of a single element alone are rarely met with. As a rule, two or more elements are found together, arranged in concentric layers around the nucleus.

The formation of a calculus is not a simple process of a deposit of salts, and it is a common occurrence for urine to contain crystals of uric acid, oxalates, or phosphates for a long time without the formation of a stone; but in the presence of albuminoid material these crystals change their molecular form, gain a tendency to coalesce and adhere to each other, also to a sort of frame-work composed of colloid material, which is furnished by the pus.

The practical deduction to be drawn from this fact is that, while crystals may be present in the urine for years without the formation of a stone, a cystitis producing pus gives the necessary stimulus to coalescence, and a stone is very liable to form.

NUMBER.

Stones are usually single, although very frequently they are multiple; sometimes five or six may be present, and instances are on record where three or four hundred stones were taken from the bladder.

It occasionally happens that a single stone becomes multiple through a process of **spontaneous fracture.**

It has been found in laboratory experiments that, if a calculus formed in a solution of gum were placed in a solution of a different specific gravity, it would split up into segments. Hence it is probable that the instances reported of the spontaneous fracture of stones in the bladder, which have been accredited to different mineral or spring-waters, is due to the effect produced upon the stone by surrounding it with urine whose specific gravity and reaction have been changed from their original state at the time of formation of the stone, by the ingestion of large quantities of water The albuminoid material forming the framework of the stone absorbs fluid and swells, bursting apart the laminæ of the stone and so fracturing it into segments.

ETIOLOGY.

For a calculus to form, it is absolutely essential that there should be a foreign body in the bladder, since the crystals must have a *nucleus* around which they may coalesce and adhere.

The nucleus may be a foreign body introduced from without, such as a broken catheter- or pipe- stem, pin, etc., or it may be a small piece of necrotic tissue which has been sloughed off from the bladder-wall.

In many cases of stone, however, the nucleus is composed of uratic crystals. These become agglomerated in the kidney and pass through the ureter, causing renal colic. They drop into the bladder, and, if they are not voided through the urethra, form a nucleus.

Predisposing Causes of Uratic and Oxalic Calculi.—As these stones are dependent upon a constitutional or diathetic state, certain things which influence the general condition of bodily health play an important rôle in their formation.

It has been generally supposed that the habitual drinking of water impregnated with the salts of lime was very apt to occasion vesical calculus. Investigations to determine this point show that the cases of calculus are not equally distributed through the limestone districts, and that they are just as common in the adjacent regions where the water is free from lime, and on these accounts the limestone theory has been abandoned.

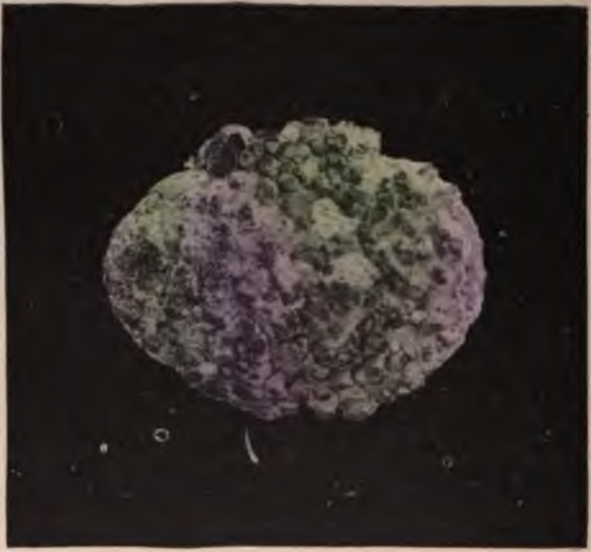


Fig. 79.—Oxalic or Mulberry Calculus. (Author's specimen, from Kings County Hospital.)

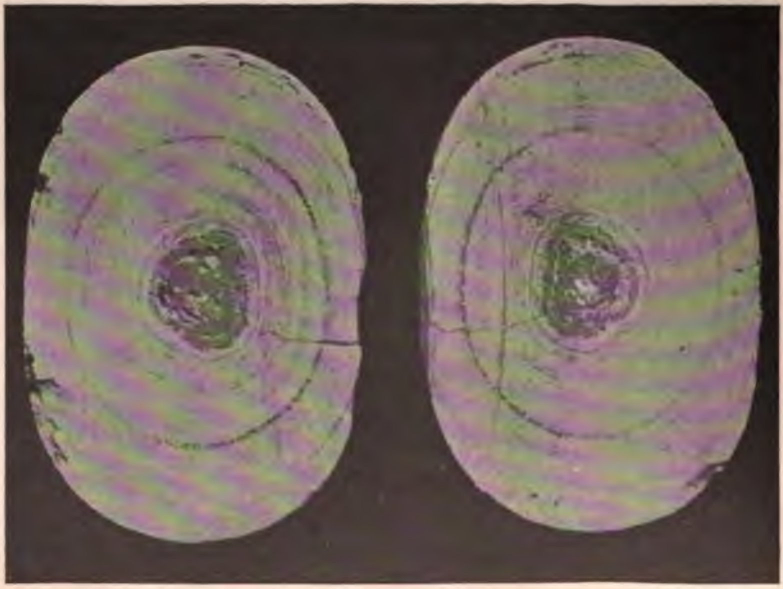


Fig. 80.—Vesical Calculus, split in two halves, showing mode of formation, by a deposit of phosphates in concentric layers, around a uric-acid nucleus. Weight, 1370 grains. (Author's specimen, from Kings County Hospital.)

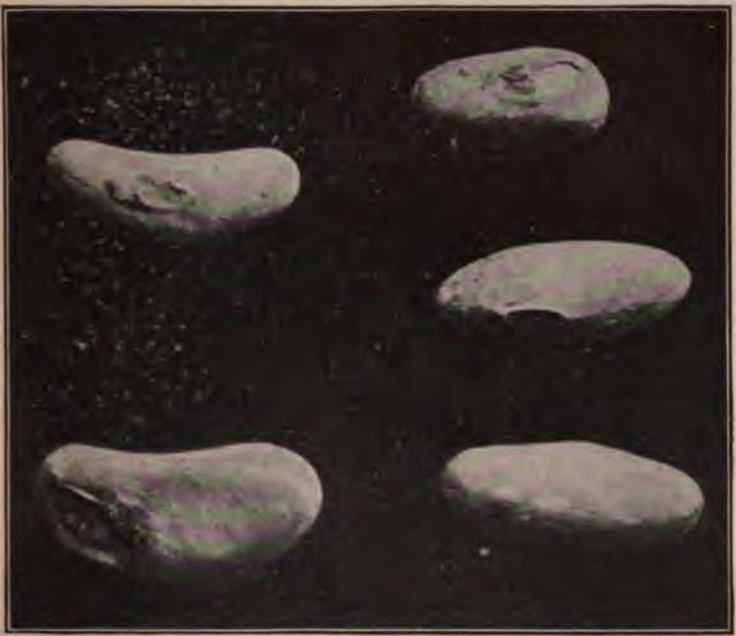


Fig. 81.—Multiple Phosphatic Calculi, removed by suprapubic cystotomy from same patient. (Author's specimen, from Kings County Hospital.)

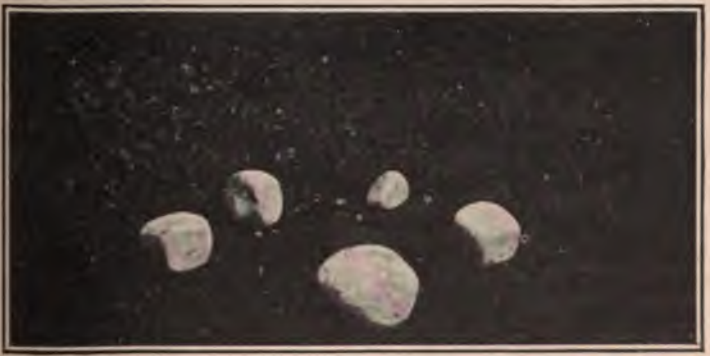


Fig. 82.—Calculi which formed in the bladder as a single stone, which underwent spontaneous fracture. Afterward fragments passed into the prostatic urethra, where they became impacted, and were removed by external urethrotomy. (Author's specimen, from Kings County Hospital.)

Diet and constitutional habit, however, are important factors in the production of stone, since the excretion of uric and oxalic acids depends upon the quality of the food and the diathesis. On this account children with feeble digestive powers, who eat largely of nitrogenous food, are unable to perform the processes of oxidation completely, and the results of the retrograde metamorphosis of the tissues are eliminated, not as urea, which is freely soluble, but as urates or oxalates.

The same is also true of adults who eat more nitrogenous food than they require, use alcohol and malt liquors freely, and take but little exercise. Such persons are subject to attacks of gout or various manifestations of lithæmia, which are included under the term of gouty diathesis.

The gouty diathesis is notably an inherited condition, and on that account different members of successive generations of a family are liable to develop oxalic or uratic stone in the bladder or some other gouty manifestation.

Phosphatic stones are not constitutional in their origin, but are dependent upon purely local causes. They result in consequence of urine decomposing and throwing down crystals of the triple phosphates, which are glued together by muco-pus, and form nuclei, around which crystallization goes on rapidly.

On this account any obstruction which prevents the bladder from emptying itself—such as stricture, hypertrophied prostate, and paralysis—allows residual urine to accumulate, and, if cystitis occurs, alkaline fermentation of the urine, deposit of crystals, and stone-formation result.

SYMPTOMS.

While it is possible for a small stone to exist for years without producing marked symptoms, and particularly so if it lie in the pouch behind an enlarged prostate, it is usual for a stone in the bladder to give rise to the following prominent symptoms: (*a*) pain, (*b*) increased frequency of urination, (*c*) blood, and (*d*) sudden stoppage of urine in full stream.

The pain is referred to the head of the penis under the glans, and shoots into the perineum and down the thighs.

It is felt especially at the end of urination, for, as the last few drops of urine are expelled, the muscular contractions of the bladder drive the stone forcibly into its neck, causing a contusion.

The pain is increased by riding in a jolting wagon, by going downstairs, or even by walking.

Increased frequency of urination occurs through the day, when the patient is about on his feet and the stone is moving in the bladder. At night, when the individual is quiet in bed, the stone does not move, and the intervals between urination are longer.

Blood never appears in any large quantity in the urine, but a few drops are squeezed out at the end of urination, or it may be mixed with urine, giving a smoky color. It is not a constant symptom, but intermittent.

Sudden stoppage of the urine in full stream is a very characteristic symptom, when it is present, and is caused by the stone being carried into the vesical outlet, obstructing it and shutting off the flow of urine like a valve.

It is rarely observed in old men with enlarged prostates, as the stone lies in the deep posterior prostatic pouch.

Cystitis always exists when a stone is present, and the symptoms of calculus are complicated by those of inflammation of the bladder.

DIAGNOSIS.

The clinical history of stone is merely suggestive of the condition, but to make a positive diagnosis the stone must be touched with an instrument or through an incision in the bladder or seen with the cystoscope.

Examination with Thompson's Searcher, or Sounding for Stone.—The patient should lie on his back, and with old men it is desirable to elevate the hips so that the stone may roll out of the post-prostatic pouch. The bladder should contain from four to six ounces of sterilized water, in order to distend its folds and allow the beak of the searcher to move freely.

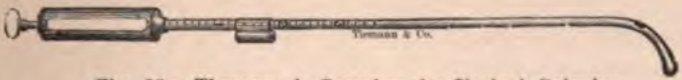


Fig. 83.—Thompson's Searcher for Vesical Calculus.

The searcher is introduced after the manner of a sound, and the trigone and post-prostatic pouch should be examined by turning the beak of the searcher from side to side and rotating it behind the prostate, as the stone always lies in the most dependent portion of the bladder.

If the stone is not touched, the fluid in the bladder should be allowed to flow out through the hollow shaft of the searcher, and, as the bladder collapses, the stone is often brought up against the point of the searcher and the impact can be felt.

There are certain precautions to be observed in sounding for stone. The patient's genitals should be cleansed and all the instruments must, of course, be sterile. Children should always be examined under chloroform, as otherwise they would be restless, and the bladder might be wounded by a sudden movement.

In old men there is a great deal of danger of urinary fever. They should be examined at home and kept in bed from twenty-four to forty-eight hours after the examination. It is always desirable to administer salol, grs. v t.i.d., or urotropin, grs. viiss t.i.d., for two days before searching.

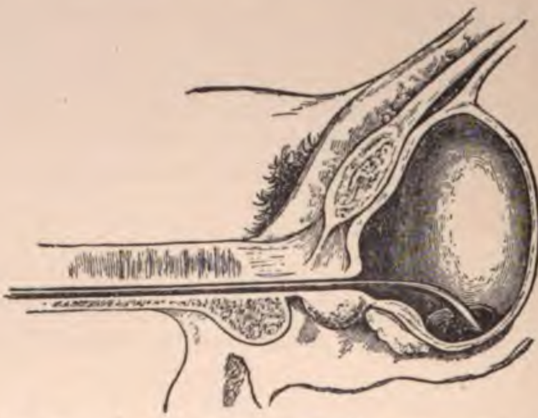


Fig. 84.—Searching for Stone lying in the post-prostatic pouch.

If there is a strong suspicion of the presence of a stone, it is advisable to make all the preparations for immediate operation, in order to avoid the reaction which so often follows an examination of the bladder.

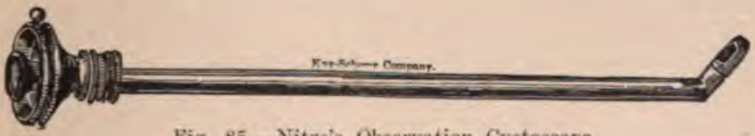
The presence of a stone is perceived by the searcher and gives rise to a sharp click, which can be felt and heard. Soft stones give a dull or muffled sound when touched, but the sound is sharper in character when a hard stone is struck.

The size of the stone may be measured by grasping it between the jaws of a lithotrite; but the determination of the *size* or *number* of the stones is difficult with the searcher, and for this purpose the **cystoscope** is of great value.

With this instrument it is possible to see the stones distinctly, unless the bladder is bleeding freely, and their size, shape, and location can all be accurately ascertained.

Phosphatic stones are white and round, uratic stones are yellowish and oval, oxalic concretions are dark and covered with bosses and sharp points; but it should be remembered that most stones are composed of different elements arranged in concentric layers. At the same time the position of the stone may be ascertained, for a stone lying in a deep pouch behind an enlarged prostate, or attached to the bladder-wall as an incrustation, or lying in a saccular dilatation will often be out of reach of a searcher, and may be overlooked.

An examination of the urine often throws light on the character of the stone by revealing the predominant form of the urinary crystals.



Kny-Scheerer Company.

Fig. 85.—Nitze's Observation Cystoscope.

The litholapaxy pump is sometimes useful in detecting a small stone which eludes the searcher. The tube is introduced and water forced into the bladder with the bulb. The outflow of the water forces the stone against the orifice of the tube, and the click is appreciable to the ear and to the touch.

Since the introduction into practice of the cystoscope the **exploration of the bladder through a suprapubic or perineal wound** is rarely called for.

In former times it was often necessary in doubtful cases, particularly in the instance of a calculus lying in a saccular dilatation or in the presence of an incrustation of the bladder-wall with urinary crystals.

PREVENTIVE TREATMENT.

The presence of crystals in freshly-voided urine which is still warm should be regarded as an indication that calculus is liable to form, and the tendency to the formation of *uratic and oxalic stones* should be guarded against by attention to the patient's general health. He should be cautioned against using an excess of nitrogenous food, sugar, or fat. It is in general thought best not to cut off all nitrogenous food, but to allow a general diet, with a reduction of the accustomed quantity of meat.

Moderate and systematic daily exercise in the open air is of great assistance in favoring oxidation.

The ingestion of large quantities of pure spring- or distilled water has the effect of diluting concentrated urine, rendering soluble its contained salts, and flushing out the kidneys.

If the urine is strongly acid, citrate of potash is indicated in order to render it neutral.

If phosphates are abundant and due to imperfect assimilation, the mineral acids, particularly phosphoric, in doses of *m*xv three times a day, and the vegetable bitters improve the digestive powers. The phosphaturia often disappears for a time and sometimes permanently under the use of urotropin, gr. viij three times a day, or benzoic acid.

The adoption of local measures for preventing the formation of **phosphatic calculi** is much oftener crowned with success.

As these stones are always caused by the decomposition of alkaline urine in the presence of cystitis, the indications are (*a*) to drain the bladder by removing a stricture, if present, evacuating residual urine, in cases of enlarged prostate or atony and distension of the bladder in paralytics, and (*b*) to cure the existing cystitis by bladder-washing.

In this way the decomposition of urine is checked and the precipitation of phosphates and carbonates ceases.

Attempts to dissolve stones after their formation have been made for many years, but, while some have been moderately successful in the laboratory, no method has yet been found which is capable of dissolving a stone in the bladder.

The various waters from mineral springs which have derived some reputation as solvents owe it to the fact, already spoken of, that in a few extremely rare instances *spontaneous fracture* of the stone occurs when the specific gravity of the fluid surrounding it is altered.

OPERATIVE TREATMENT.

Litholapaxy, or crushing the stone and immediately washing out the fragments from the bladder, is the operation of choice in all cases of vesical calculus.

It is a prerequisite of the operation that : I. The lithotrite and evacuating catheters should be introduced easily and without wounding the urethra or prostate. In children under sixteen years of age litholapaxy is regarded by many surgeons as inadmissible on account of the small size of the bladder and urethra.

It is advised, however, by others whenever the urethra is large enough to admit the instruments.

II. The stone must be *movable in the bladder*, of *moderate* size, and *not too hard.*

If a stone lies in a saccular dilatation or is adherent to the bladder-wall, it cannot be crushed. Very large stones form such a great quantity of *débris* after crushing that the operation of washing out becomes too protracted.

The *contra-indications* to litholapaxy are (*a*) extreme prostatic hypertrophy. The prostate may be so much enlarged that the lithotrite cannot be introduced, or, even if passed into the bladder, it cannot reach and grasp the stone as it lies in the post-prostatic pouch.

(*b*) Tight stricture of the deep urethra. Such a narrowing of the urethra will prevent the passage of the instruments, and requires external urethrotomy for its cure, and, at the same time, the stone may be removed through the perineal wound, although if very large it may have to be crushed with a lithotrite first.

(*c*) Severe cystitis which does not yield to ordinary treatment. In this condition it is better to remove the stone through an incision, which will subsequently serve for the prolonged drainage of the bladder and at the same time afford an opportunity for its irrigation.

(*d*) Contracted and irritable bladder does not admit of sufficient distension, and is too intolerant of instruments to allow the stone to be crushed.

(*e*) Nephritis and suppurative pyelitis, since uræmic coma and death follow litholapaxy, when the kidneys are diseased, more frequently than after the cutting operations.

Technique.—The patient, with his rectum previously emptied, is anæsthetized, lying upon his back. The hips are elevated, to allow the stone to roll out of the post-prostatic pouch.

The bladder is washed out and filled with six to eight ounces of boric-acid solution or oxycyanat of mercury solution.

The lithotrite is passed through the urethra after the manner of a sound, and rests on the floor of the bladder behind the prostate, with its beak pointing upward. The lithotrite, from its weight, sinks in and forms a depression in the wall of the bladder. Ordinarily the stone lies along the beak of the lithotrite, and when the jaws are opened it rolls in between them. The jaws are closed and the stone is felt to be grasped. If the jaws fail to seize the stone, the blades are opened in the upright position, turned over on one side, and shut along the floor of the bladder. If the stone is not found, the manœuvre is repeated in the opposite direction.

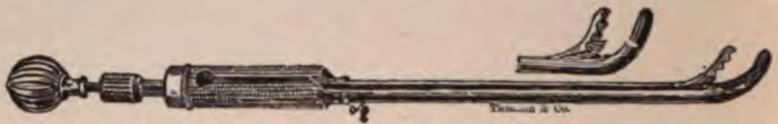


Fig. 86.—Bigelow's Lithotrite.

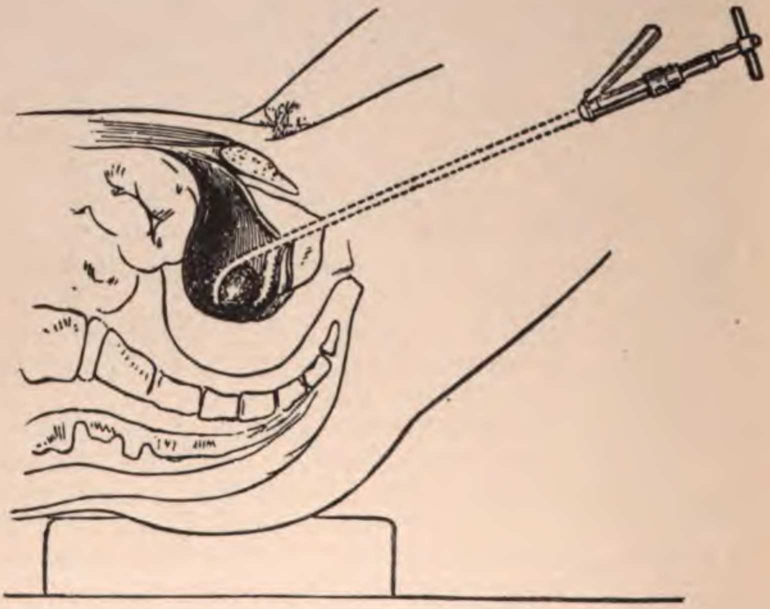


Fig. 87.—Method of grasping the stone in lithotrity.

If the stone lies in a deep post-prostatic pouch, raising the patient's hips may roll it out within reach, or it may be pried up by a finger in the rectum.

In the event of these failing, the jaws of the lithotrite may be turned so as to point downward, in the hope of seizing the stone as it lies; but in this case there is always danger of nipping and cutting out a piece of the bladder-wall.

When the stone has been caught between the jaws, the resistance it offers is easily felt on approximating them. The blades of the lithotrite are then locked, and by turning the handle the jaws are screwed together, comminuting the stone into fragments. The manœuvres of opening the jaws, catching the stone, and breaking it are repeated until the surgeon perceives that no large fragments are left, and the lithotrite is withdrawn.

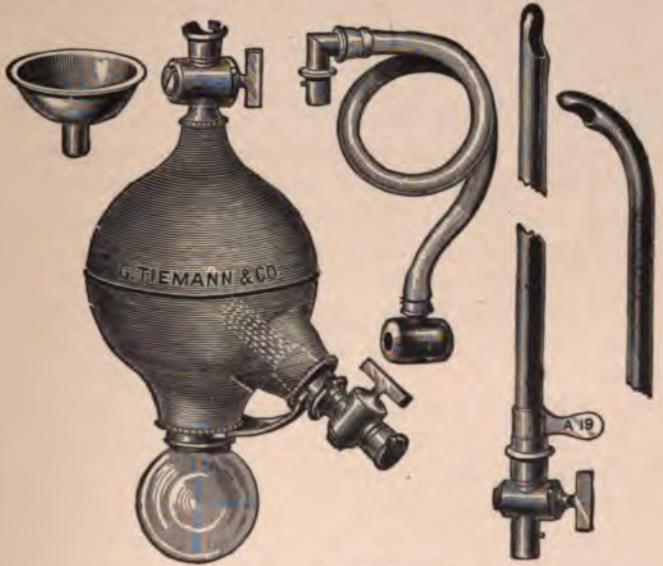


Fig. 88.—Bigelow's Evacuator.

The next step is the *evacuation of the debris*. The evacuating tube is introduced into the bladder and its contained fluid allowed to flow out with a gush, carrying with it some of the fragments. The bladder is then filled with water by pumping in the contents of the bulb, and the fluid then flows out again into the receiver, carrying more fragments. The pumping is continued till no more fragments come away, and ausculatation over the bladder fails to perceive the click of a fragment remaining behind which is too large to enter the tube. If this is the case the lithotrite should be introduced again and the piece crushed and pumped out.

The after-treatment consists in keeping the patient in bed and allowing him to drink freely of water, to keep the kidneys active.

If retention of urine occurs, it is well to tie a catheter in, in order to avoid the irritation of its frequent passage.

After ten days have passed the bladder should be pumped once more to remove the sand and mucus which are left and which might serve as a nucleus for another stone, and the entire absence of fragments should be verified by a cystoscopic examination.

Mortality of Litholapaxy.—The following statistics, compiled by Cabot, show the death-rate at different times of life:—

Children, under 14,	241	cases,	with	4	deaths	= 1.66	per	cent.
Adults, 14 to 50,	400	"	"	13	"	= 3.25	"	"
Old men,	433	"	"	26	"	= 6	"	"

Perineal Lithotomy.—Until within a few years, and before the technique of litholapaxy and suprapubic lithotomy was perfected, the only way of removing a stone was through a perineal incision.

As these methods came into general use, the perineal operation was to some extent abandoned, except in children; but when a cutting operation is required, perineal lithotomy possesses the advantage of causing less shock than the suprapubic operation, and is well adapted to the removal of small stones and for certain complications which are described below.

Perineal lithotomy offers the advantage of good drainage for the bladder; but if an attempt is made to remove a large stone through the perineal wound, the bruising and laceration of the tissues often leads to infection and sloughing.

In addition, a large stone requires such an extensive lateral incision through the prostate that many blood-vessels are divided and hæmorrhage may be difficult to control.

Perineal lithotomy has always been considered a dangerous operation in the case of old men with enlarged prostates, on account of the bruising and laceration to which the prostate is subjected while the stone is being withdrawn.

Hypertrophy of the prostate adds very much to the difficulty of reaching a stone from the perineum, on account of the increase of the perineal distance.

At the present time the feeling is that, when dealing with a stone complicated by enlarged prostate, it is safer to enucleate the prostate first, through the perineal incision, and then afterwards, as the bladder has settled down, the stone can be reached and removed with but little difficulty.

If the stone be too large to extract through the perineal incision, Harrison's lithoclast may be used to break it up into fragments, which can be readily brought out through the wound.

The indications for **median perineal lithotomy** may be tabulated as follows:—

(*a*) Small stones of not more than 1¼ inches in diameter, complicated by stricture of the urethra, which demands external urethrotomy.

(*b*) Small stones in the presence of atony of the bladder with no expulsive power, and chronic cystitis, provided that the prostate is not very much enlarged.

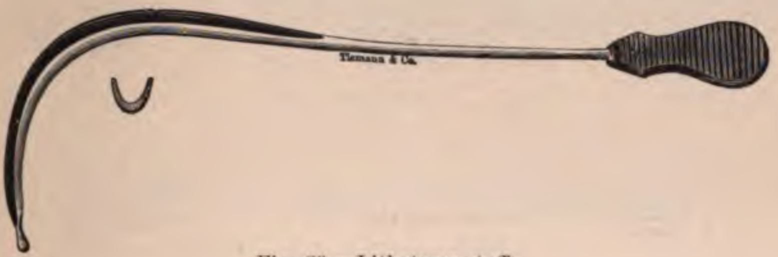


Fig. 89.—Lithotomy-staff.

(*c*) Contracted and irritable bladder, which does not admit of sufficient distention for suprapubic cystotomy and is too intolerant to allow litholapaxy.

(*d*) Small or moderate-sized stones, complicated by senile hypertrophy of the prostate, which is suitable for the operation of perineal prostatectomy.

Perineal Lithotrity.—Reginald Harrison has enlarged the scope of median lithotomy by devising a lithotrite which is introduced through a median incision and by which stones of considerable size can be crushed in the bladder and removed through the perineal wound.

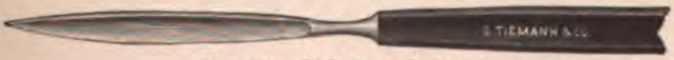


Fig. 90.—Lithotomy-knife.

Perineal Lithotomy.—Technique.—(a) Median Operation.—An incision is made in the median line, which is simply a *boutonniére,* or external urethrotomy, and is performed by introducing a grooved lithotomy-staff through the urethra into the bladder.

The staff is held steadily by an assistant and the surgeon makes a direct thrust or stab with a long, straight bistoury, an inch and a half in front of the rectum, through the tissues lying in front of the urethra, and strikes the groove in the staff. A gorget is then slid along the groove until it enters the bladder, which is explored by means of the finger. If a stone is found, it is grasped by the stone forceps and withdrawn, if not too large.

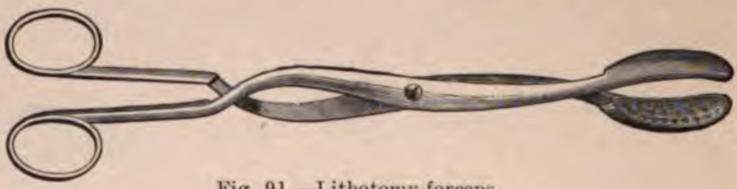


Fig. 91.—Lithotomy-forceps.

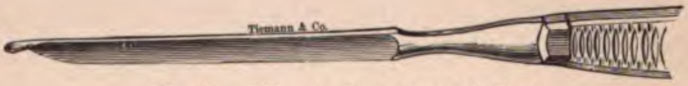


Fig. 92.—Blizard's Probe-pointed Knife.

If the stone prove too large to pass through the wound, (*b*) *perineal lithotrity* may be performed by introducing Harrison's litho-

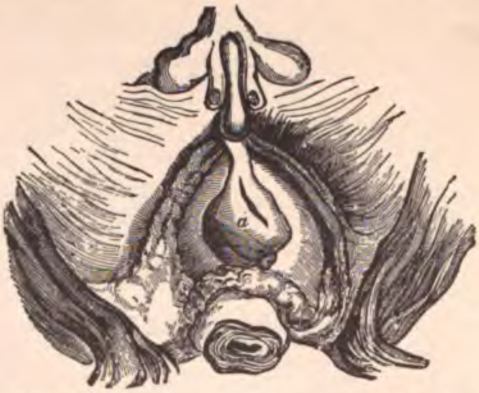


Fig. 93.—Incision through the urethra and prostate in lateral lithotomy.

trite, crushing the stone, and either extracting or pumping out the fragments with a litholapaxy evacuator.

The operation may, if desired, be converted into (*c*) *lateral perineal lithotomy*, which was the operation formerly used exclusively in all cases of stone. A Blizard knife is slid along the groove in the staff, as it rests in the bladder, until the point of the knife has entered the bladder. The knife is then withdrawn, making a sweeping cut, outward, downward, and a little to the left, enlarging the original median incision and cutting through the left lobe of the prostate, the perineal muscles, and the skin.

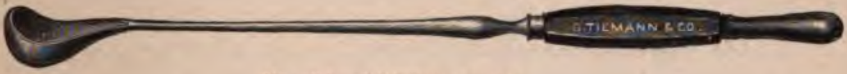


Fig. 94.—Lithotomy-scoop.

In this way the incision is made of sufficient size to permit the extraction of large stones with the forceps or scoop; but, on account of the drawbacks of hæmorrhage and laceration of the tissues, this form of lithotomy is rarely used at the present time.

After-treatment of Perineal Lithotomy.—The wound is never sewed, but is left to heal by granulation. Hæmorrhage is inconsiderable after the median operation, and is easily controlled by a gauze packing around a large soft-rubber catheter. It is often very severe after a lateral lithotomy, and often requires the use of the shirted cannula to hold it in check.

The *mortality of perineal lithotomy* has been tabulated by Freyer and Rosenthal, as follows:—

Deaths before the 20th year......	5 to 8 per cent.
" in adults	10 " 15 " "
" above the 40th year......	32 " 39 " "

These figures refer, in the main, to the operation of lateral lithotomy, and apply less to median lithotomy or lithotrity.

Suprapubic Lithotomy.—Suprapubic lithotomy was first performed in the year 1550 by Pierre Franco, but did not gain favor until 1880, when the application of aseptic methods and improvements in the technique of the operation reduced the previously high rate of mortality.

At the present time, in the cases where litholapaxy cannot be applied and a cutting operation must be employed, suprapubic lithotomy is the operation of choice in dealing with stones over 1½ inches in diameter.

The *advantages* of suprapubic over perineal lithotomy are:—

(*a*) The suprapubic operation admits of complete inspection and evacuation of the bladder.

(*b*) Wounding the ejaculatory ducts, neck of the bladder, and rectum, and dangerous hæmorrhage from incised blood-vessels are avoided.

(*c*) The laceration and bruising of the tissues, which occurs when a *large* stone is dragged through a perineal wound, are avoided.

(*d*) The bladder is rendered easy of access, while in the presence of a considerable degree of prostatic hypertrophy the perineal distance is so much increased that it may be impossible to reach the bladder from below.

The *disadvantages* are:—

(*a*) A much greater degree of shock and prostration following the operation than exists after perineal lithotomy.

(*b*) The difficulty of keeping the patient's bed and dressings from being soaked with urine, which escapes from the suprapubic wound.

The special indications for suprapubic lithotomy have been tabulated as follows:—

(*a*) Very large stones, even though they be soft. (*b*) Large hard stones. (*c*) All fixed stones, incrustations of the bladder-wall, sacculated stones, etc. (*d*) Cases where a high degree of prostatic hypertrophy exists which prevents the seizure of the stone by the lithotrite.

The technique of the operation is based upon the anatomical fact that, when the bladder is filled, the fold of peritoneum, which lies in front of it, is raised up two inches above the pubes, leaving a space, called the space of Retzius or prevesical space, *uncovered by peritoneum*, through which the bladder-wall may be safely incised.

Technique.—The India-rubber bag which was used in the earlier operations for distending the rectum, and so bringing the bladder nearer to the abdominal wall, is rarely, if ever, employed at present. The Trendelenberg posture is only exceptionally required.

A catheter is introduced through the urethra and the bladder is filled with from eight to twelve ounces of sterilized water, by means of a syringe. Helferich and Bristow use air for this purpose.

The catheter is withdrawn and a rubber band is tied around the root of the penis.

An incision is made in the median line of the abdomen, beginning three inches above the pubes and extending down over it, which divides the skin and subcutaneous fat. There is no linea alba in this region and the incision is carried directly through the muscular bundles, and the transversalis fascia is divided. The edges of the wound are held apart by large angular retractors and the bladder appears lying at the bottom of the wound. It is recognized by its shape and by the prevesical fat, which is adherent to it. If any doubt exists, it may be punctured with an exploring hypodermic syringe.

In old men the peritoneal fold in front of the bladder is sometimes unusually long, and extends down low, into the space of Retzius. In such a case it should be peeled up from the bladder and held out of the way. If the peritoneum is accidentally wounded, it should be at once sewed up with fine catgut.

After the bladder is exposed, it should be steadied with a sharp hook, thrust through its wall at the upper angle of the wound, and two long silk retraction sutures are passed through the bladder-walls, at the sides of the wound.

These are held by an assistant and the bladder is opened between them by means of a stab-like thrust, with a long, sharp bistoury. As the water in the bladder is flowing out, the incision may be enlarged to the desired extent by means of a straight, blunt-pointed bistoury.

The cavity of the bladder is then searched with the finger, and the stone removed with a lithotomy-scoop or forceps. If it is desired to inspect the interior of the bladder, its walls may be distended by Watson's bladder speculum and the cavity illuminated by Pilcher's electric lamp or a head-mirror and reflected light.

The advisability of sewing the wound in the bladder or of leaving it open is still under discussion. All authorities, however, agree that in the presence of severe suppurative cystitis and foul purulent urine, the bladder should not be sewed, but left open for drainage. With a moderately-healthy bladder in young persons, opinions differ, and the following plans are adopted:—

(*a*) The wound in the bladder-wall is closed by two layers of sutures.

The first row is so arranged as to bring the serous surfaces in contact, without allowing the sutures to appear upon the inside of the bladder, and the second row is placed above the first and holds the incision tightly together, preventing leakage. The space of Retzius is packed with gauze, and the wound in the abdomen left open for several days. If the stitches in the bladder hold, the abdominal wound may be closed by secondary suture. Drainage of the bladder is provided for, by a permanent catheter introduced either through the urethra or preferably through a small perineal incision.

(*b*) In addition to suturing the wound in the bladder, the abdominal incision is also closed by sutures, excepting the lower angle, through which a wisp of gauze is inserted for drainage.

It is the practice in Germany, at present, to close the wounds in the bladder and abdominal wall by a double layer of sutures, in nearly every case of suprapubic cystotomy.

In most instances the wound heals by primary union, the convalescence is shortened, and the patient is saved the annoyance of the constant leakage and dribbling of urine during the weeks in which the wound is healing.

(*c*) The wounds in the bladder and abdominal wall are not sutured, but are left open and allowed to heal by granulation.

By this latter method the convalescence is prolonged and the patient is subjected to a great deal of inconvenience from the urine flowing out over the wound and wetting the bed continually. To avoid this objection, these plans for drainage have been suggested:—

(*a*) Guyon's double tubes. Two large rubber drainage-tubes are introduced through the abdominal wound into the base of the bladder, and gauze packed around them.

(*b*) In addition to the suprapubic tubes, permanent catheterization through a *boutonnière* is carried out.

(*c*) The Dawbarn bladder-drain, which consists of a reservoir of water hung upon the wall and from which the water flows out through a rubber tube. This rubber tube is connected to a single tube introduced into the bladder by a T-shaped glass tube. As the water flows out of the reservoir a suction is created which keeps the bladder empty.

(*d*) The Bloodgood bladder-drain, which is a rubber bag attached to a hard-rubber tube entering the bladder. The urine flows out through it and is collected and retained in the rubber bag.

The length of time required for the healing of the wound is from two to three weeks when the bladder is sutured, and from three to six weeks when the wound is left to heal by granulation.

The after-treatment may be attended with difficulties, and there is always danger of urinary infiltration of the walls of the wound. In order to avoid this it has been recommended, and particularly so in the presence of a foul cystitis, to open the abdominal wall first, and to make the incision into the bladder several days later.

In the time elapsing between the two operations granulations have had time to form and septic absorption is prevented.

The *mortality statistics* of suprapubic lithotomy collected by Cabot show the following results:—

Age.	Cases.	Deaths.	Precentage.
Adults, 14 to 50 years..	100	12	12
Old men	53	17	32

OPERATIONS FOR CALCULUS IN CHILDREN.

Perineal Lithotomy.—The median operation is impracticable in children, on account of the difficulty in withdrawing a stone through the small posterior urethra. For the same reason Harrison's lithotrite cannot be used. The lateral operation, however, can be readily performed with much greater safety than in adults, for, as the prostate and urethra grow larger, they become more vascular, and the danger of hæmorrhage increases.

The lateral operation has a drawback in the danger of wounding the ejaculatory seminal duct and producing sterility on that side, in after-life. The mortality is about 3 per cent., and lateral lithotomy is still generally considered to be the operation of choice in the case of small stones in children.

Litholapaxy in children is attended with some difficulties, on account of the small size of the urethra interfering with the introduction of the lithotrite and the relative hardness of the stones, as met with. In spite of this it has been performed a great many times, and the death-rate is low: only about 3 per cent. As far as the death-rate is concerned, there is but little choice between lateral lithotomy and litholapaxy.

Suprapubic cystotomy in children is more dangerous, according to the collected statistics, than either of the other operations, the mortality being about 10 per cent., although stones one and one-quarter inches in diameter or over are considered too large for lateral lithotomy and must be removed through a suprapubic incision.

The size of a stone is readily estimated in children by the bimanual examination with one finger in the rectum and the other hand over the bladder.

CYSTOSCOPY.

Until the year 1879 the only means of studying pathological changes in the bladder was upon the autopsy table, but the invention of the cystoscope by Nitze at this time marked an epoch in the progress of genito-urinary surgery.

There are at present two forms of the cystoscope in use: one in which the observer looks directly at the object, through a tube provided with lenses or otherwise. The Brenner cystoscope and Howard Kelly's tubes are representatives of this class. *Second,* the cystoscopes with prisms inserted in the vesical end of the shaft, through which the observer sees the object reversed in the vertical diameter, as in the Nitze-Leiter instrument.

For merely observing the alterations in the bladder, the Nitze observation cystoscope is the most useful instrument, on account of its large field of view.

For ureteral catheterization opinions are divided as to the best instrument. With the direct-view instrument of the Brenner type, as modified by F. Tilden Brown or Cabot, it is possible to catheterize the ureters with great ease, provided they can be seen.

It often happens, however, that from various causes the ureter openings cannot be brought into view, and consequently the catheter cannot be introduced.

On account of the difficulty of finding the ureters with the direct view instrument, the double catheterizing cystoscope of the Nitze type, known as the Bierhoff-Frank cystoscope, is in general to be preferred.

With this instrument the ureters are more readily found, but it requires more experience and a certain skill in technique to catheterize them.

It is of the greatest importance that whatever form of instrument is used it should be one by which both ureters can be catheterized simultaneously; for the present diagnostic methods as applied to diseases of the kidney demand a comparison between the right and left urines which are secreted at the same moment.

In cases of pyuria, especially when tuberculosis is suspected, it is usually better not to use the cystoscope at once for diagnosis, but to relieve the cystitis by washing the bladder with nitrate of silver, 1 to 1000, three times a week for a fortnight.

The urine should, during this time, be examined for crystals, pus, and tubercle bacilli.

After fourteen days of bladder-washing, when no improvement occurs, the patient may be examined with the cystoscope.

If cystitis is present, it may be primary or secondary to disease in the kidneys. Hæmorrhages or cystitis bullosa around the mouth of one ureter indicate that the kidney on that side is diseased.

To determine the condition of the kidneys, catheterization of the ureters is the only means of diagnosis.

The objection which was formerly urged against this procedure, on account of the danger of infection of the kidneys, is unfounded.

After the ureters have been catheterized the patient should drink three or four quarts of water, to wash out any organisms which may have been introduced, and urotropin, gr. vij, t. i. d., should be given internally.

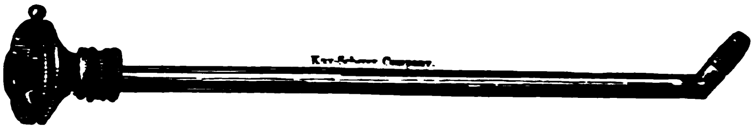


Fig. 95.—Nitze's Observation Cystoscope.

In Casper's clinic it is the custom to examine the bladder with the observation cystoscope one day, and if found necessary to catheterize the ureters, to wait until the following day before doing so.

Technique of Cystoscopy.—There are certain conditions which are necessary to the performance of cystoscopy:—

I. The urethra must be large enough to admit the cystoscope.

II. It is desirable for the bladder to hold at least five ounces; with this quantity it can be examined easily with the cystoscope. The minimum quantity of fluid which is necessary for cystoscopy is three ounces, but more fluid is necessary for catheterizing the ureters.

III. A clear medium is required, for if the fluid in the bladder is turbid from blood or pus it is impossible to see anything.

The *contraindications* may be briefly stated, as any acute inflammation, and in general, bladder tuberculosis.

It is always well to proceed with the examination of the bladder in a systematic manner, and the following scheme is used in Casper's clinic:—

1. Note capacity of bladder.
2. Form of sphincter of bladder.
3. Appearance of bladder.
4. Form of ureter openings.
5. If changes are present around ureter opening.
6. If pus or blood issues from the ureter.
7. Configuration of the floor of the bladder.
8. Examine posterior part of the bladder, by sinking the ocular end of the cystoscope.
9. Examine the bladder-walls by turning the cystoscope around so that the beak points upwards.

Immediately before the examination, the patient divests himself of trousers and drawers and lies on his back on a suitable table, with his legs resting on stirrups in the lithotomy position.

The urethra should be thoroughly irrigated with oxycyanat-of-mercury solution, 1 to 4000, and the bladder is first emptied of urine with a catheter and then irrigated to remove all pus and blood.

One drachm of a 4-per-cent. cocaine solution is instilled into the posterior and anterior urethra with an Ultzmann's syringe, or a 2-per-cent. eucaine solution is injected into the anterior urethra with a P syringe.

The bladder is then filled through a catheter with from 4 to 8 ounces of sterile water or a solution of oxycyanat of mercury, 1 to 4000.

The electric current is turned on and the cystoscopic lamp tested. The current is then shut off, the instrument lubricated with glycerine, particularly the lamp and window covering the lens, and introduced. The light is then turned on and the examination begun. The technique of introducing Cabot's instrument differs in some particulars.

As most of the diseased processes occur in the trigone and about the ureteral openings, the beak of Nitze's cystoscope is turned down and these parts are carefully inspected.

As the cystoscope is withdrawn toward the operator a dark zone covers the window; this is the prostate, and if the instrument is farther withdrawn the light is entirely obscured, as the cystoscope enters the urethra.

After the middle and lateral lobes of the prostate have been examined, the trigone should be inspected for evidences of cystitis or for calculus.

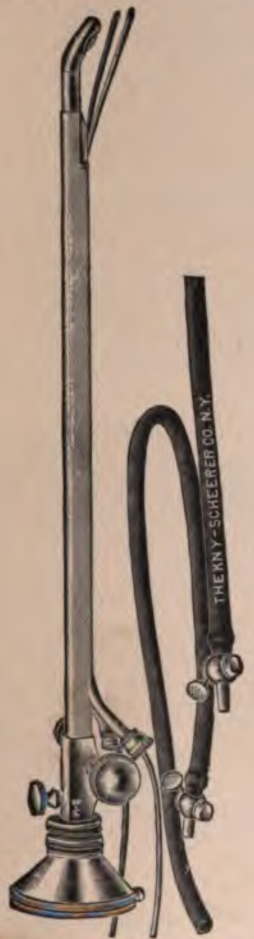


Fig. 96.—Bierhoff-Frank Cystoscope, for catheterizing both Ureters simultaneously.

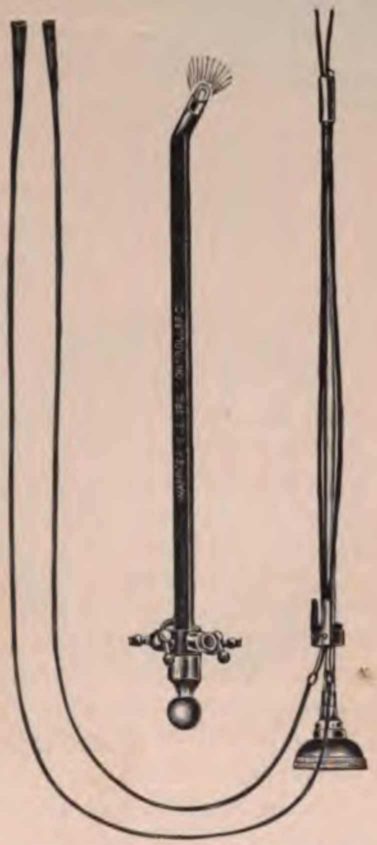


Fig. 97.—Cabot's Cystoscope for catheterizing the Ureters.

The ureteral orifices should next be sought for. The conformation of the ureteral orifice often suggests disease of the kidney.[1] Positive evidence of disease of the kidney, however, can only be attained by **catheterization of the ureters.**

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[1] Ureteric Meatoscopy in Obscure Diseases of the Kidney, E. Hurry Fenwick, 1903.

For this purpose one of the forms of catheterizing cystoscopes is employed. The ureters are brought into the field of vision and the catheters are introduced into both open ureteral mouths.

They are allowed to remain there for a few minutes, or until enough urine has been collected in a bottle for examination, and then the catheters are withdrawn.

There are many forms of catheterizing cystoscopes in use, and each one has its own special advantage; but with any instrument a very considerable amount of practice is required to find the ureters in every case.

The most important landmark is the inter-ureteral line, which is the posterior boundary of the trigone, and is formed by the pink mucous membrane of the bladder shading off into the lighter membrane of the trigone. The ureteral openings are found at its lateral terminations.

They appear as slits situated on a slight elevation and are often recognized by a swirl of urine which is seen issuing from their mouths.

After the cystoscopic examination has been completed, the bladder should be emptied and washed out with a 1 to 4000 nitrate-of-silver solution, to avoid the danger of exciting cystitis.

Cases of *acute cystitis* are difficult to examine with the cystoscope, for the injection of a sufficient quantity of water to distend the bladder causes severe tenesmus and causes it to expel its contents.

Hence the cystoscope should not be used in acute cystitis, unless some urgent indication is present.

On introducing the cystoscope into an inflamed bladder, the observer notes that the normal grayish-yellow color is changed into a red, which varies from a pale to a blood red, and may be generally diffused or limited to certain areas.

The blood-vessels show marked changes. In acute cases the vessels are seen engorged with blood, but in chronic cases the vessels are no longer to be recognized as such.

Superficial hæmorrhages of irregular shape and size are to be seen in acute inflammations. In chronic cases, hæmorrhages are also present, but less extensive and of a darker color.

The mucous membrane has lost its brilliance, is swollen and softened, and appears dull, spongy, and velvety.

The diseased portions are in localized areas and do not extend equally over the whole bladder.

The swelling of the mucous membrane may be so great in spots that it bulges out into the bladder and may be mistaken for a polypus. More or less of the catarrhal secretion may usually be seen, adhering to the walls or floating free in the cavity of the bladder.

In order to differentiate between acute and chronic cystitis, it is to be noted that in acute cystitis the blood-vessels are highly engorged and the changes in the mucous membrane and the hæmorrhages are limited to circumscribed spots; while in the chronic form the swelling and softening of the mucous membrane and involvement of a considerable area are prominent features.

All forms of cystitis occurring where there is an obstruction to emptying the bladder, as in stricture, hypertrophy of the prostate, paralysis of the bladder, etc., are accompanied by hypertrophy of the muscular fibres of the wall, forming trabeculæ, and more or less diverticulum formation is apt to occur.

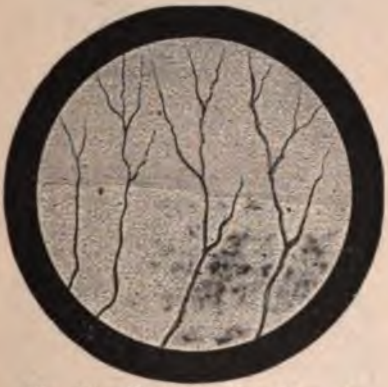

Fig. 98.—Posterior boundary of Trigone and blood-vessels. Normal Bladder.[1]

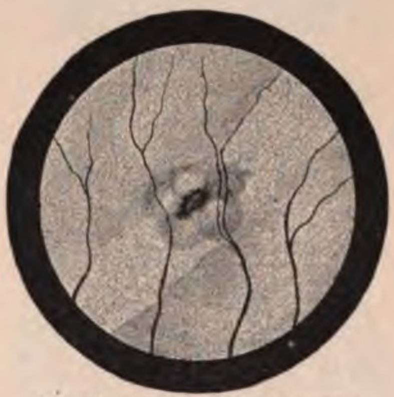

Fig. 99.—Orifice of Ureter upon elevation. Normal Bladder.

Ulcerations of the bladder are, in general, significant of tuberculosis, although they occasionally occur in very severe forms of cystitis and sometimes result from an inexperienced operator burning the bladder-wall with the cystoscopic lamp.

Tuberculosis, however, may be strongly suspected when ulcerations and numerous blood extravasations are present and the intervening areas of mucous membrane are nearly or quite normal.

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[1] The author is indebted to Dr. Henry G. Spooner and the Post-graduate Medical Journal for illustrations Nos. 98 to 107.

The location of tuberculous ulcers depends on the source of infection.

In descending tuberculosis the ulcerations are about the ureters; if the infection extends from the prostate and vesicles, the fundus is the seat; and in primary tuberculosis of the bladder, the nodules begin on the posterior wall.

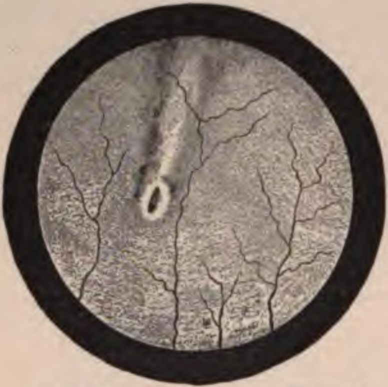

Fig. 100.—Ureter expanding as urine issues from it.

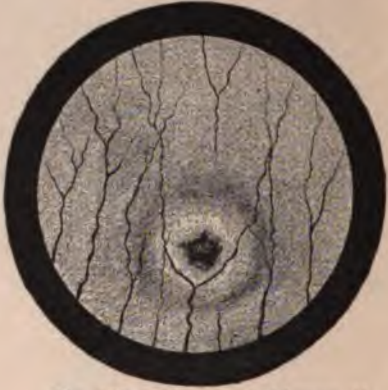

Fig. 101.—Ureter of old man dilated from calcareous degeneration.

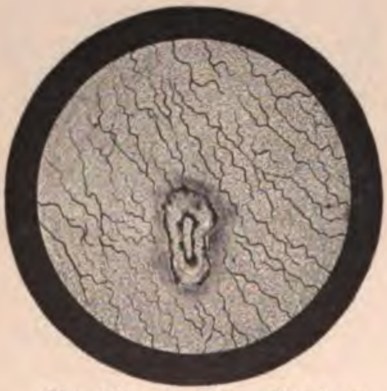

Fig. 102.—Cystitis. Blood extravasation and distended vessels.

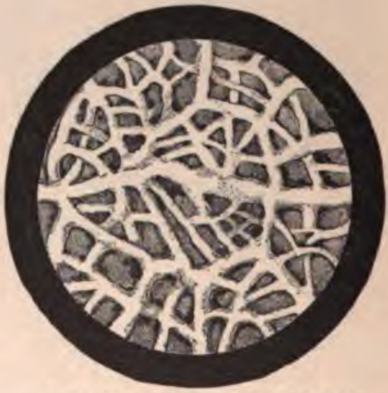

Fig. 103.—Trabeculated Bladder.

Tuberculous ulcerations always result from the cheesy degeneration and breaking down of tuberculous nodules, but cases seldom come under observation early enough for the nodules to be seen.

When present, however, the cystoscope shows the floor of the bladder beset with nodules, the size of a barleycorn and of a gray color, and in other parts of the bladder small ulcerations appear.

Of all the pictures seen with the cystoscope, bladder *tumors* are the most characteristic and well-marked, as they project prominently from the surface of the bladder-wall. They may be sessile or pedunculated, and are usually located near the orifice of a ureter or the urethra.

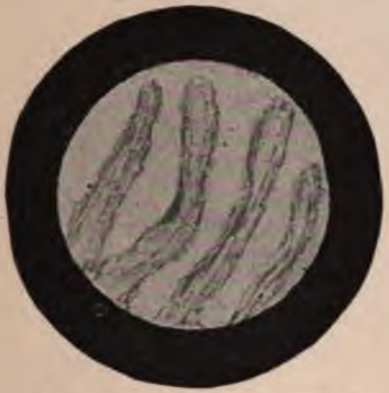

Fig. 104.—Villous Papilloma of Bladder.

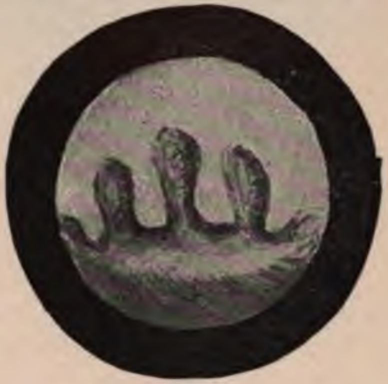

Fig. 105.—Papilloma from neck of Bladder.

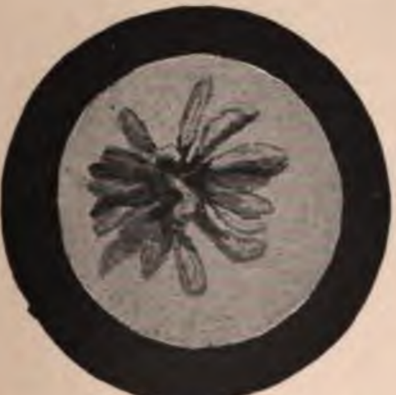

Fig. 106.—Cauliflower-shaped Papilloma of Bladder.

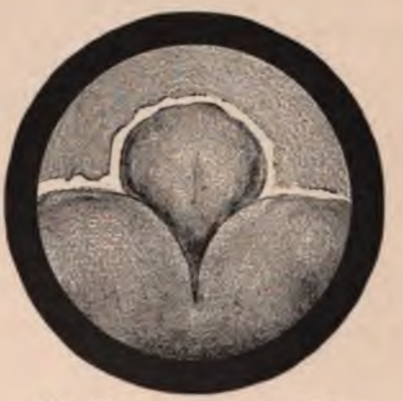

Fig. 107.—Hypertrophy of median lobe of Prostate.

Generally the tumors are multiple, and a complete examination should include the entire bladder.

Hæmorrhage often interferes with the view, and one of the forms of the irrigating cystoscope may be required in order to see. Adrenalin solution injected into the bladder is sometimes of use, but the bleeding may be so excessive that examination with the cystoscope is impossible.

On account of the difficulty of introducing the instrument and the danger of a traumatism, with subsequent bladder infection, cystoscopy can frequently not be employed in cases of *hypertrophied prostate.*

In a few cases, however, where rectal palpation shows no enlargement of the gland and yet when the patient cannot empty his bladder, the cystoscope will show an enlarged middle lobe, which blocks the vesical outlet and prevents the outflow of urine.

Without the cystoscopic examination it is impossible to differentiate such cases from arteriosclerosis of the vessels of the genito-urinary tract, with consequent degeneration of the detrusor muscle, which presents a similar clinical picture.

Vesical calculus is very easy to diagnose with the cystoscope, while if it is very small or lies in a pouch behind the prostate or in a bladder diverticulum, it may be quite impossible to touch with a stone-searcher.

It is difficult to estimate the size of a stone accurately with the cystoscope, as it apparently increases or diminishes with the focal distance of the instrument.

The color of the stone is a guide to its constituents. Uratic calculi are pale yellow, phosphatic are white, and oxalates are brownish or nearly black. The number of stones present cannot be accurately determined with the searcher, but can be counted with the greatest ease by means of the cystoscope.

SEGREGATION OF URINES.

The difficulties attendant on ureteral catheterization, led to the employment of other means to secure the separate urines from each kidney.

All of these devices act by establishing a watershed in the bladder, with a ureter on either side.

The **Harris segregator** may be taken as the type which is generally used in this country.

Technique.—The patient is placed in the lithotomy position, with the hips slightly elevated. The instrument, with its flattened surfaces in contact, is introduced into the bladder like a sound. The catheters are then rotated so that their beaks point downward, thus bringing the perforated ends of the catheters in the neighborhood of the ureteral openings.

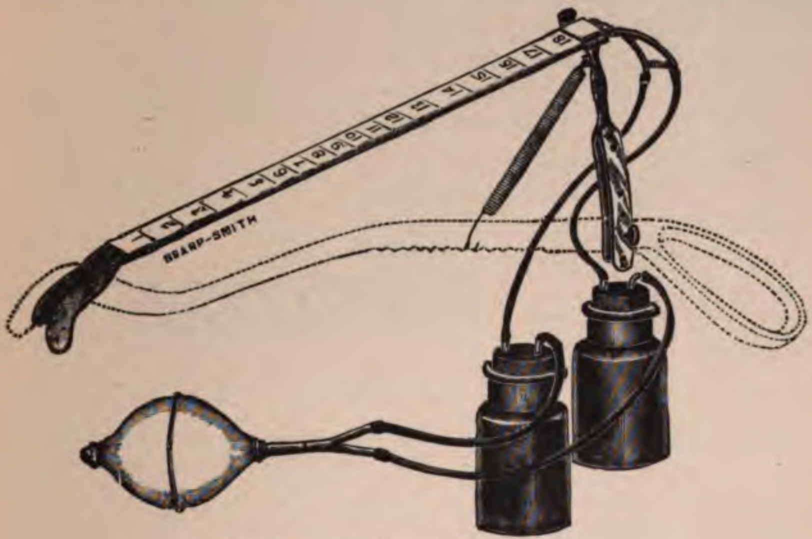

Fig. 108.—The Harris Segregator.

The lever is now introduced into the rectum of the male or the vagina of the female, and by gentle pressure the base of the bladder is elevated into a longitudinal fold, which acts as a watershed between the ureters. The end of each catheter now lies in a little pocket containing a ureter and separated from each other by the watershed.

The bladder is washed and filled with boric-acid solution, which is allowed to flow out through the instrument after its introduction, thus establishing a siphonage action. This may be facilitated by exhausting the air with a rubber-bulb attachment, to start the flow of urine.

The results obtained by the Harris instrument are fairly accurate, but, of course, are not as absolutely to be depended upon as collecting the separate urines by ureteral catheterization, as there is an opportunity for the urines to become mixed through various failures in the technique of the operation.

Still, in the cases where ureteral catheterization cannot be employed, the Harris segregator should always be used, and if several tests made on the same patient give uniform results, the findings may be considered as fairly conclusive.

A great objection, however, to all forms of segregators is that, when the bladder is affected and cystitis is present, more or less pus derived from the bladder-walls appears in the urine, masking the clinical picture.

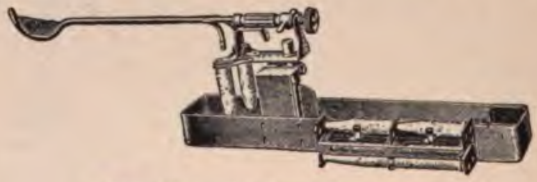

Fig. 109.—The Luys Segregator.

In European clinics the **Luys segregator** is the one most in use. As it lies entirely within the bladder without any rectal attachment, it is less uncomfortable for the patient, and findings obtained with it are as accurate as with any of the other forms of segregator.

It consists of a metal instrument shaped like a Benique sound, which is introduced into the bladder. After it is in place a screw is turned, separating the two blades. The watershed is formed by a sheet of rubber, which is stretched between the two blades of the instrument.

ENURESIS IN CHILDREN.

Nocturnal incontinence of urine is a very frequent source of annoyance in childhood. It may continue uninterruptedly from infancy, or may begin after the fourth or fifth year, and affects boys and girls with equal frequency.

The incontinence usually occurs only at night, as during the day the child is able to control it by the exercise of the will; but sometimes the irritability of the bladder is so marked, even by day, that unless the child responds at once to the call, the urine is passed in the clothes. At night the emptying of the bladder does not take place when it is over-filled with urine, but usually occurs three or four hours after going to bed.

THE ETIOLOGY

of enuresis is very obscure and it has been variously regarded as a paralysis or faulty development of the sphincter vesicæ, as a spasmodic contraction of the detrusor, or as a mere irritability of the posterior urethra.

Casper explains the condition by assuming that there is a faulty relation between the innervation of the detrusor muscle of the bladder and its sphincter. This permits of a spasmodic contraction of the detrusor which is strong enough to overcome the muscular tone of the sphincter.

Before deciding that the trouble is purely functional, it is necessary to exclude certain local conditions, such as balanitis or phimosis, irritation in the rectum from pin-worms or obstinate constipation, vesical calculus, cystitis or tuberculosis of the bladder, foreign body in the urethra or a narrow meatus, excessive acidity of urine, and in female children an adherent clitoris.

General conditions may also play a part more or less directly in causing enuresis; epilepsy, rachitis, diabetes, polyuria, and nephritis may all be responsible for this symptom.

A want of proper bringing up may here and there be responsible for the condition, and in a few cases it is due in the first place to carelessness. The child wakes at first, but will not take the trouble to get up to empty his bladder. Later on he does not wake up thoroughly and voids the urine in the bed semi-unconsciously.

TREATMENT

is generally effective, both in the cases where a cause can be discovered and removed, and also in the purely functional cases.

In children suffering with functional enuresis, the *diet* should be regulated, avoiding all indigestible and fermentative foods and not allowing any drink for an hour before going to bed. The child should be awakened once or twice at night and made to empty his bladder, and he should sleep on a hard mattress and not too warmly covered.

Belladonna is the drug upon which most reliance is to be placed.

It should be given in increasing doses until the physiological effect is obtained or until the child is cured.

The dose, on beginning, for a child four years old, may be 3 drops three times a day, increased 1 drop daily. When 10 or 15 drops of tincture belladonna have failed to control the enuresis, aromatic tincture of rhus has been successfully used, increasing the dose gradually to 30 minims a day.

If this fails, Osthiemer and Levi[1] advise a solution containing $^1/_{240}$ grain of atropin and $^1/_{480}$ of strychnine to the drop. The initial dose of this is one drop a day, increased one drop daily until symptoms of the physiological action of atropin or strychnine appear or the enuresis ceases. Under these plans of treatment 75 per cent. of recoveries may be expected.

Elevating the foot of the bed on two chairs is recommended by Stumpf, as in this way the urine in the bladder does not press down against the sphincter. The explanation of the method of action is not entirely clear, but the clinical fact is well attested.

Faradization of the bladder three or four times a week, is a valuable measure. One pole is placed over the bladder region against the symphisis, and the other is carried into the rectum. The strength of the current is graduated to the patient's feeling and is often followed by success.

In cases where these measures fail, local treatment of the urethra with sounds and instillations of nitrate of silver may be tried. On account of the timidity and nervousness of children, it is very difficult to use instrumentation of any sort within their urethras, and the liability of a sudden movement causing a false passage must always be borne in mind.

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[1] Journal of the American Medical Association, December 17, 1904.

DISEASES OF THE PROSTATE.

CHAPTER XIII.

SENILE HYPERTROPHY OF THE PROSTATE.

THE prostate is placed like a sphincter around the first inch of the urethra. It consists of two lateral lobes and a median central portion connecting them, which is sometimes spoken of as a third, or median lobe. In its histological structure it resembles the uterus in the female, and is composed of muscular fibres, glandular elements, and a connective-tissue stroma uniting them.

While the gland may be enlarged as a result of gonorrhœa or sexual abuses in young men, *true hypertrophy* of the prostate never occurs until the decline of life, when other degenerative changes incident to advancing years begin. It is almost never observed until the patient is *past his fiftieth year.*

Sir Henry Thompson states that hypertrophy of the prostate exists in 34 per cent. of men at and above 60 years of age, and that it produces manifest symptoms in about 15 or 16 per cent. of the cases, when it is enlarged.

For many years the *cause* of prostatic hypertrophy was the subject of much speculation, although Virchow, in his work on tumors, stated that it was due to chronic inflammation which started in the glandular substance of the prostate.

This view did not attract much attention and the general opinion was that a certain amount of enlargement of the prostate was a senile process.

In very recent times the work of Ciechanowski,[1] published in 1900, and of R. H. Greene and Harlow Brooks, of New York,[2] demonstrated positively that the enlargement is due to a chronic inflammatory process, which usually has been in progress for many years.

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[1] Mitteil. a. d. Greuz gebieten d. Medizin u. Chirurgie, vii Bd., Jahr 1900; English translation by Dr. Robert Holmes Greene; published by E. R. Pelton, 1903.

[2] Nature of Prostatic Hypertrophy, Journal of the American Medical Association, April 26, 1902.

In frequent instances this inflammation may be of gonorrhœal origin, but not necessarily so.

The inflammation begins in the prostatic urethra, near the verumontanum, and when not due to gonorrhœa may be very often accounted for as the result of excessive irritation from over-functional activity or from some form of unphysiological sexuality, such as masturbation or coitus reservatus.

These acts lead to a violent engorgement of the posterior urethra, and unless the congestion is relieved by a period of absolute rest, the tendency to a low grade of chronic inflammation soon develops, in which, no doubt, micro-organisms carried by the blood-current or urine have a contributory action.

PATHOLOGY.[1]

The pathological change consists in a general enlargement of the entire organ, or the increase in size may be confined to one or both lateral lobes or to the median lobe. The character of the enlargement of the gland and its size and consistency depend upon which of the normal tissues of the prostate have been chiefly affected by the process of hypertrophy.

Prostatic hypertrophy occurs in two distinct forms, fibrous and adenomatous. The **fibroid variety** of hypertrophy is due to a hyperplasia of the connective-tissue elements of the prostate, which lie between the tubules.

The growth and contraction of this tissue result in the compression of the gland tubules, which atrophy in consequence, so that in the pure fibrous hypertrophy, the gland is transformed into a firm fibroid mass, containing a few glandular elements.

This variety is often irregular in shape, for the reason that the hyperplasia does not take place equally in all parts of the gland.

It has been asserted that the involuntary muscle fibres in the prostate participate in this form of hypertrophy, but more recent investigations apparently exclude muscular hyperlapsia.

The cause of the fibroid form of prostatic hypertrophy is un-

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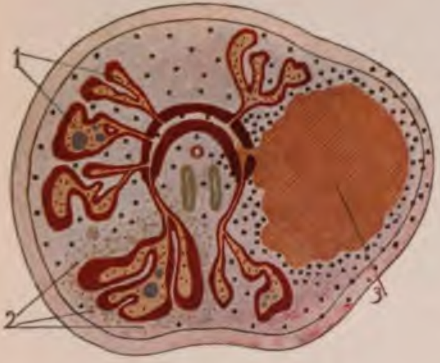
[1] For the description of the pathological changes in prostatic hypertrophy, the author is indebted to a personal communication courteously made to him by his friends, Drs. R. H. Greene and Harlow Brooks.

On account of the difficulty in demonstrating the pathological changes occurring in diseased conditions of the prostate, the following series of diagrams was made, under the direction of Dr. Harlow Brooks, by Mr. J. H. Henrici, at the author's suggestion, hoping that a diagrammatic representation would make the conditions more intelligible to students.

I.



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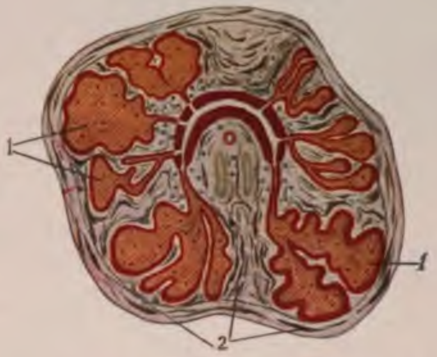

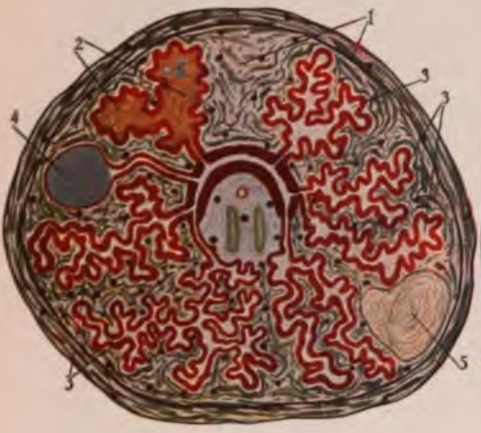

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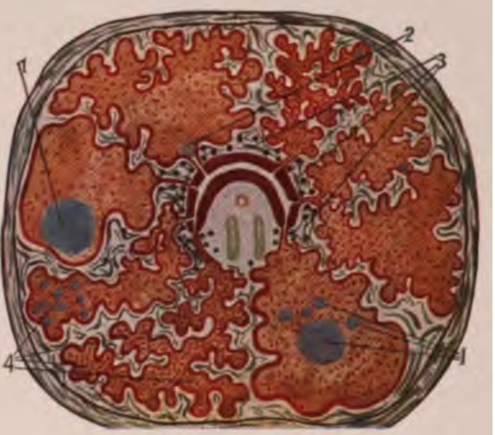

IV.

I. SUPPURATION OF LATERAL LOBE OF PROSTATE.

1. Dilated tubules containing exudate (catarrhal inflammation).
2. Interstitial hyperplasia about miliary abscess.
3. Large abscess rupturing into urethra.

II. CHRONIC PROSTATITIS.

1. Dilated tubules filled with exudate, pus, and desquamated epithelium.
2. Hyperplastic connective tissue.

III. HYPERTROPHY OF PROSTATE (FIBROID TYPE).

1. Interstitial hyperplasia.
2. Dilated tubule filled with secretion.
3. Tubules compressed by increase of interstitial tissue.
4. Encysted amyloid body.
5. Fibroma.

IV. HYPERTROPHY OF PROSTATE (ADENOMATOUS TYPE).

1. Amyloid bodies.
2. Duct occluded by amyloid body.
3. Hyperplastic connective tissue most marked about ducts.
4. *Dilated tubules* containing exudate and desquamated epithelium.

doubtedly the same as that causing connective-tissue hyperplasia elsewhere, viz., *inflammation.*

Connective tissue of inflammatory origin, after the acute stages which excite its growth have passed, always contracts, as in the formation of a cicatrix.

It may thus happen that a small, hard prostate will in some cases result as a terminal stage of the fibroid form of prostatic hypertrophy, although this form of pure fibroid hypertrophy is exceedingly rare.

The **adenomatous form** is characterized by the presence of round or oval tumors of a semi-elastic consistence, which form in the substance of the prostate gland.

In the adenomatous form the epithelial or secreting elements of the gland are involved by the hyperplasia; the result being that greater or less increase in the number and size of the tubules of the gland is occasioned. The connective-tissue elements in the pure type of adenomatous hyperplasia are not at all or but slightly increased. In this form of prostatic hypertrophy the tubules of the gland frequently become dilated and elongated, and are filled with (*a*) the secretion of the cells, which is more or less inspissated; (*b*) by proliferating cells derived from the walls of the acini, or (*c*) by the detritus resulting from the disintegration of these cells.

The nodules formed may range in size from a pea to a hen's egg, and each may contain many or few acini.

This type of prostatic hypertrophy is induced by inflammation, as in the first-named variety; but in the adenomatous form the inflammation affects primarily the tissues surrounding the excretory ducts, and by the compression of these ducts the secretion becomes dammed up within the tubules of the gland, which thus become distended.

This is accompanied by an inflammation, which excites the epithelium of the secreting tubules to growth, and by the proliferation of these cells, new acini are formed. It is thus evident that, while the structure of the tumor resembles that of ordinary adenomata, its etiology and manner of growth exclude it absolutely from the new growth formations.

The cyst-like nodules formed in the adenomatous type of prostatic hypertrophy, thus originate from the distension and growth of the normal tubules, which have become obstructed and hyperplastic, as the result of inflammation acting as above described.

The nodules may thus consist of a single occluded and distended tubule, with its wall, or of any number of hyperplastic tubules, of greater or less size, depending upon their individual distension.

The **mixed type** of prostatic hypertrophy is by far the most frequent. In it, both the tubules and connective tissue of the normal gland partake in the process, and as a result areas of fibrous formation are found, intermingled with enlarged and cystic tubules. Thus the nodules found in this variety consist both of fibroid masses and adeno-cystic tumors.

Carcinoma not infrequently arises, as a complication of the changes described in hypertrophied prostate, as is shown particularly by Albarran and Hallè.

The **size** to which the prostate may grow depends upon the nature of the tissue involved. The prostate may be only slightly increased in size or it may become as large as a hen's egg or an orange, and in very exceptional instances may reach the size of a cocoa-nut, and fill up the entire pelvis.

Form of Obstruction.—In certain cases the lateral lobes may be enlarged, but in such a way as not to interfere with the urinary outlet, and it is possible to empty the bladder entirely. As a rule, however, **the posterior median portion, or third lobe**, becomes enlarged, and assumes the shape of a bar or dam across the mouth of the bladder, behind which the urine accumulates and cannot flow out, or the outgrowth may be more circumscribed in form and act as a ball-valve, which shuts down over the vesical orifice.

Alexander has recently suggested that the enlarged prostate interferes with the rhythmical contraction of the detrusor muscle, in the region of the trigone, and the bladder, on this account, is incapable of emptying itself of the last few ounces of urine, which are normally expelled by the action of this muscle. This view will serve to account for the cases in which there is no appreciable obstruction in the shape of a projecting growth from the prostate, but where residual urine accumulates.

In many instances the enlargement of the prostate does not produce any symptoms, and it is only of consequence when it acts as an obstruction placed at the outlet of the bladder, thus preventing it from completely evacuating its contained urine.

The various symptoms and diseased conditions which occur in consequence of the prostatic hypertrophy are all due to two conditions:—

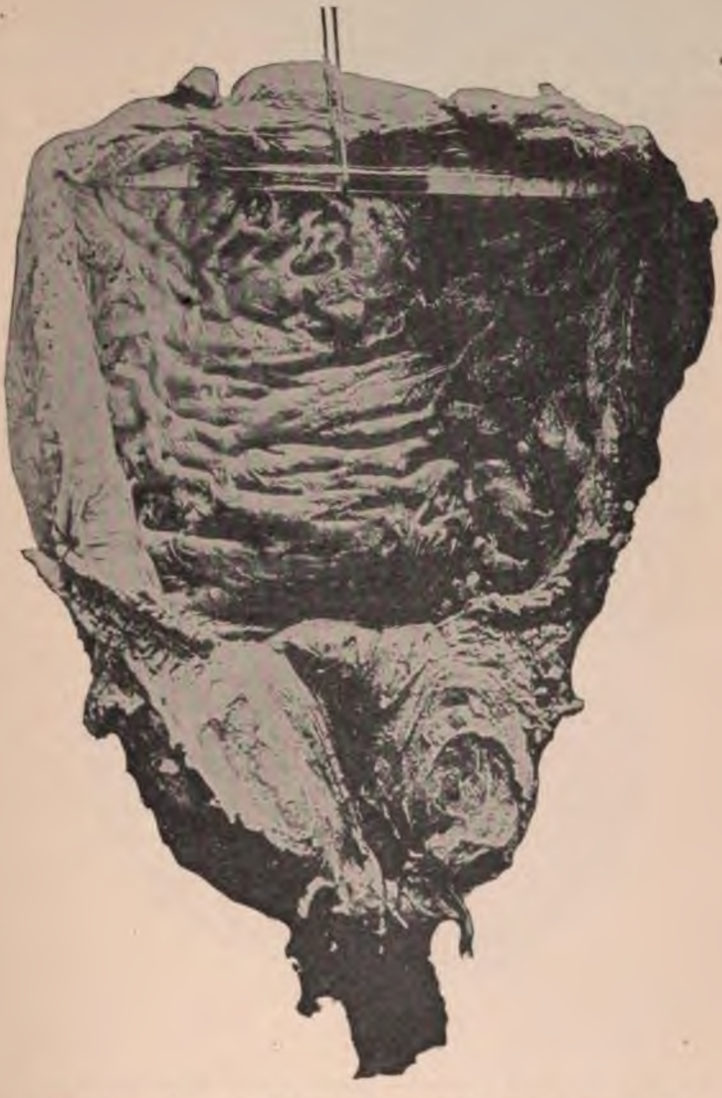

Fig. 110.—Prostatic Hypertrophy. Median enlargement, in the form of a bar. Suitable for Bottini's Operation. A large bladder. (By courtesy of Dr. F. S. Watson.)

(*a*) The obstruction caused by the enlargement of the prostate at the vesical outlet interferes with the urinary outflow, and the bladder cannot be completely emptied by the muscular efforts of the patient. Residual urine accumulates, pathological changes occur in the bladder-wall, and secondarily the ureters and kidneys become affected.

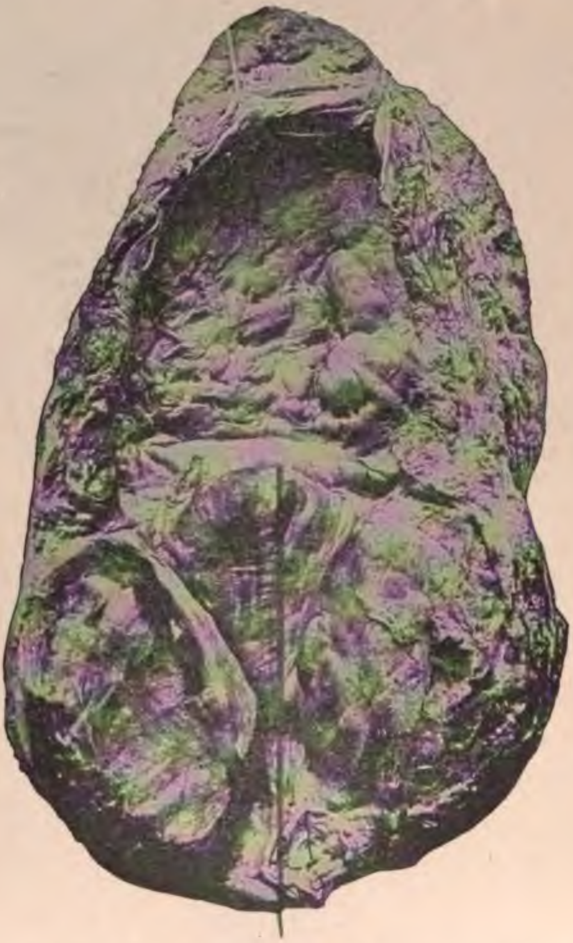

Fig. 111.—Prostatic Hypertrophy. Enlargement of lateral lobes and median portion. Bladder contracted and non-distensible. (By courtesy of Dr. F. S. Watson.)

(*b*) The return-flow of venous blood from the bladder-wall is prevented by the pressure exerted upon the veins by the enlarged prostate, and a congestion of the bladder-walls occurs as a result.

Changes in the Urethra.—In consequence of the enlargement of the prostate, notable alterations occur in the prostatic urethra:—

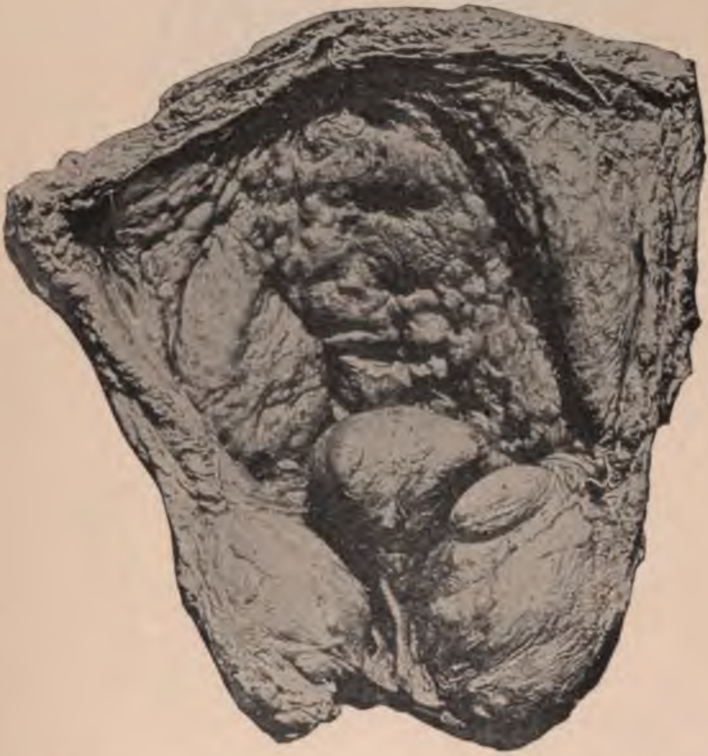

Fig. 112.—Prostatic Hypertrophy. Enlargement of lateral and median lobes. Deep post-prostatic pouch. (By courtesy of Dr. F. S. Watson.)

(*a*) It becomes elongated.

(*b*) The normal curve is changed.

(*c*) The calibre of the urethra, instead of being round, is flattened from side to side by the pressure of the lateral lobes, so that it becomes a vertical slit.

As a result of these changes catheters of ordinary shape are often inapplicable to cases of prostatic hypertrophy, and special catheters have to be employed.

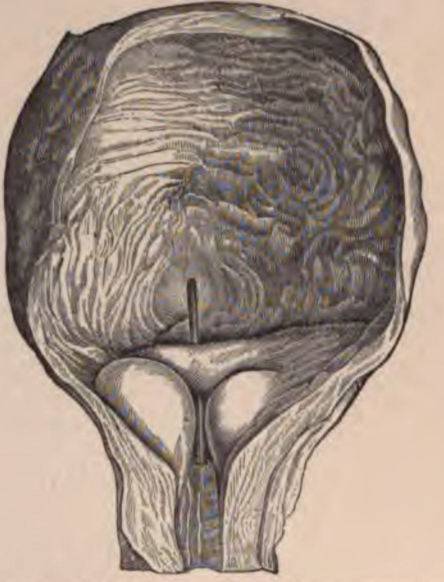

Fig. 113.—Prostatic Hypertrophy. Enlargement of the lateral lobes, with increase in size of the median portion, forming a bar, through which a false passage has been made.

SYMPTOMS.

One of the first symptoms of enlarged prostate which a patient observes is:—

I. Difficulty in starting the flow of urine.

In addition to this is noted:—

II. Deficiency in the force of the stream.

Both of these symptoms are occasioned, in part, by the feeble and atonic condition of the muscular fibres of the bladder, and partly on account of the prostatic obstruction.

III. Frequent calls to urinate, especially at night.

This symptom is explained by the fact that the enlarged prostate presses on the plexus of veins lying around it, and so obstructs the flow of venous blood. As the blood from the bladder is returned

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through this plexus, any interference with its circulation causes a passive congestion of the bladder-walls. Through the day the muscular activity improves the circulation, but at night the muscles are in repose, and a passive hyperæmia occurs.

The increased frequency of urination at night, often helps to distinguish a case of enlarged prostate from one of vesical calculus. In the case of a stone the desire to urinate is more frequent during the day, when the stone is rolling about in the bladder, but at night the patient is quiet in bed, and the stone does not cause much irritation.

One of the most important conditions from the standpoint of treatment and prognosis, which enlarged prostate gives rise to, is **residual urine.** Residual urine may be defined as the urine which remains in the bladder after the patient has voluntarily tried to evacuate it completely, and always occurs as a result of an obstruction.

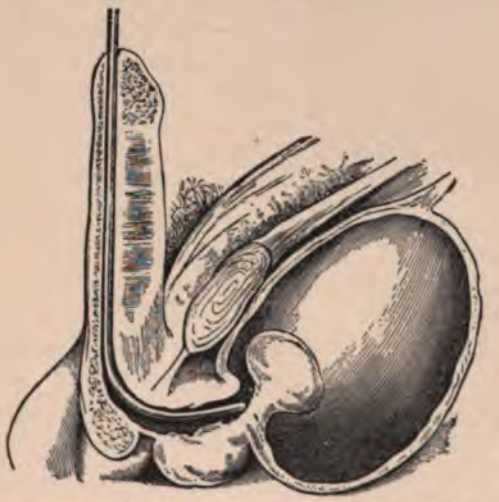

Fig. 114.—Prostatic Hypertrophy. Pedunculated middle lobe obstructing passage of a catheter.

Residual urine exists in the majority of cases of prostatic hypertrophy, and in the early stages and in cases of slight obstruction may only amount to an ounce or two. The tendency is, for it is to increase in quantity as the bladder-walls become atonic and the prostatic enlargement becomes more developed; so that in exceptional cases it may reach a quart in quantity.

After residual urine has existed for a varying length of time **cystitis** is generally excited by the entrance into the bladder of micro-organisms, coming from the urethra or rectum or introduced artificially upon a dirty catheter.

The causation of cystitis is favored by the stagnant residual urine and also by the catarrhal mucus, which is formed in the congested mucous membrane lining the bladder, as a result of its condition of chronic passive hyperæmia.

The urea of the urine is decomposed by bacterial action, assisted by the presence of the catarrhal mucus, and carbonate of ammonia is set free. The urine becomes alkaline in reaction and ammoniacal in odor, is strongly irritating, and adds still further to the existing inflammation of the bladder-wall.

When cystitis is well established, the frequency of urination is increased, and the patient *urinates as frequently by day as at night.*

The mucous membrane of the bladder surrounding the urethral orifice becomes turgid and congested, and serves to occlude still more the outlet from the bladder, and the residual urine increases. The various changes dependent upon cystitis and obstruction lead to **changes in the wall of the bladder.** In order to furnish sufficient propelling force to overcome the obstruction formed by the prostatic overgrowth, the muscular fibres of the bladder-wall undergo **hypertrophy.** The bundles of muscular fibres grow larger and project into the bladder, and diminish its capacity.

The muscular efforts of the bladder force the urine between the bundles of muscle, and in time **saccular dilatations** form, which may be as large as the bladder itself. As these sacs are only covered outside with peritoneum and the serous wall of the bladder and have no muscular fibres, they cannot empty themselves. In consequence, the urine stagnates and decomposes, and it frequently happens that a calculus forms in them.

In course of time as the case progresses the hypertrophy gives place to **atrophy and distension.** The distension of the thinned bladder-wall may be very great; so much so, that it may contain a quart of residual urine and reach as high as the umbilicus.

The distension occurs so gradually that the patient is unaware of his condition, and notices only a slight feeling of weight in the abdomen, and that his habitually frequent urination is slightly increased. As the residual urine increases, the bladder grows more distended and the intervals between the acts of urination become still shorter. After the bladder is stretched and distended to its utmost capacity a new symptom occurs; that of **incontinence of urine, or constant dribbling.**

The bladder is so full that it can hold no more, and the overtaxed sphincter yields, allowing the escape of a small quantity of urine every few minutes.

The conditions of decomposing residual urine and cystitis just described provide suitable conditions for the formation of **phosphatic calculi.** As Keyes expresses it, "Stone is the logical sequence of obstruction to urinary outflow aided by vesical catarrh."

The stagnant decomposing urine deposits salts, which become glued together by a muco-pus into a solid concretion, or are deposited upon a nucleus, which may be a bit of necrotic tissue sloughed off from the bladder-wall.

A single stone, or several, may exist without causing any symptoms, and they may lie unsuspected for months in the pocket behind an enlarged middle lobe. Their surfaces are smooth, and they are prevented from rolling about in the bladder, and the weakened muscular fibres of the bladder cannot drive them forcibly out of the post-prostatic pouch against the vesical orifice during the act of urination.

It sometimes happens that after hypertrophy begins, the bladder-wall, instead of growing weakened and atonic and ultimately becoming dilated, undergoes **hypertrophy with contraction.** In this condition the overgrowth of the prostate does not form an obstruction to the outflow of urine, and residual urine does not accumulate, and the bladder, instead of being distended and enlarged, undergoes a *diminution in the size of its cavity,* so that it may only contain six or eight ounces of urine when fully distended.

In addition to the contraction of its size there is also a permanent congestion of the vesical neck from pressure on the veins, by the enlarged prostate. This venous engorgement occasions an extreme irritability of the bladder, with an almost constant desire to urinate.

Of the two conditions spoken of, the patient with an atonied, relaxed bladder which does not cause him trouble, even though it is incapable of emptying itself except by catheter, suffers far less inconvenience than the man who has an hypertrophied, irritable bladder, and is tormented continually with an intolerable desire to urinate.

Changes in Kidneys and Ureters.—As the obstruction offered by the prostate increases, a greater amount of muscular effort is required to empty the bladder, and as a result of the pressure, the urine is forced back into the ureters, causing them to become distended, and sac-like dilatations form at various points.

The backward pressure and damming back of the urine are continued, and saccular dilatations of the pelvis of the kidneys occur, giving rise to **hydronephrosis.**

The salts of the stagnant decomposing urine are deposited, and calculi are apt to form in the various dilatations in the kidney.

The process of dilatation becomes further complicated by germ-infection, which usually ascends up the ureters, and as a result causes pyelitis or abscess of the kidney.

Retention of urine occurs in nearly every case of enlarged prostate, and presents itself in two forms:—

(*a*) *Acute Retention.*—This occurs suddenly in an individual who up to that time had been able to pass water with a fair degree of freedom. It is frequently brought on by chilling or wetting the surface of the body and taking cold. The sudden congestion of the mucous membrane around the vesical orifice causes it to swell up and occlude the opening entirely, in the same way that a cold in the head will close up the nasal passages.

On the other hand, the retention may be occasioned by a spasmodic contraction of the cut-off muscle (spasmodic stricture), which occurs as a reflex from constipation and scybalæ in the rectum, or an acid condition of the urine from overindulgence in wine or malt liquors.

(*b*) *Chronic retention*, as already described, is caused by the obstruction at the vesical outlet from the enlarged prostate and partly induced by the atonic condition of the muscular walls of the bladder.

DIAGNOSIS.

In the case of a man over fifty years of age, complaining of difficulties of urination, enlarged prostate should always be suspected.

It is desirable to conduct the examination systematically, and to that end

I. A rectal examination should be made, to feel the prostate and judge of its size and consistency and to determine, if possible, whether the enlargement is fibrous or glandular in character.

Of course, only the posterior portion of the gland can be felt through the rectum, and it is impossible to determine the shape of the obstructing overgrowth in this way, but its density and the extent of the enlargement of the entire gland can be determined by the rectal touch.

II. The quantity of residual urine should be collected and measured after the following method: The patient is requested to pass water, and endeavors to empty the bladder completely. A catheter is then introduced into the bladder, and all the urine which remains behind and which the patient has been unable to void spontaneously is known under the term "residual urine." The residual urine should be measured and set aside for microscopic examination.

The *quantity* of residual urine indicates the extent to which the prostatic enlargement interferes with the complete emptying of the bladder; but in order to determine the *shape* of the outgrowth which projects up into the bladder and blocks its outlet, we must have recourse to the cystoscope.

At the time of collecting the residual urine we can also determine the *length of the urethra* by measuring the distance from the eye of the catheter to the point upon its shaft to which it is necessary to introduce it before the urine begins to flow. This measurement often fails to demonstrate an existing enlargement, as a decided amount of obstruction may be present which causes but very little elongation of the urethra.

III. By means of a **cystoscopic examination** it is possible to see the enlargement of the middle lobe projecting upward, and to some extent to see a lateral lobe, if it impinges upon the vesical outlet. As the cystoscope is introduced through the urethra it will also serve to exclude the presence of a *tight stricture,* and by its use in the bladder we can prove the presence or absence of *vesical calculus,* which is so apt to be present in cases of enlarged prostate with residual urine.

There are certain **precautions to observe** in every examination of prostatic cases: The patients are old men whose vitality is low and who are more or less feeble. Their urinary passages are in an irritable condition, and they are very liable to *urinary fever*, and any prolonged or rough examination is apt to be followed by chills, fever, and constitutional disturbances. For these reasons the instruments should be aseptic, and when practicable it is desirable to cleanse the urethra and bladder by irrigation before instrumentation.

The instruments should be used with extreme gentleness to avoid any traumatism, which would allow entrance of micro-organisms into the circulation, and the first examination should not be too prolonged

It is desirable that the patient should be examined for the first time in his own home, so that he can go to bed at once after the examination, and thus avoid the necessity of going out-of-doors, running the risk of chilling the body

A distended bladder should never be emptied at the first sitting. Cases are on record where sudden death has occurred when a full bladder has been emptied by the catheter with the patient in a standing position.

Although such an event is, of course, rare, drawing off the entire contents of the bladder allows the enlarged blood-vessels which have been accustomed to the support of a certain amount of fluid to collapse, and a transudation of blood follows; so much so that a great deal of hæmorrhage may occur, and the existing cystitis is always made worse.

If the bladder is considerably distended, it is always better to leave one-half or one-fourth of its contents in it, or to inject six or eight ounces of warm normal salt or 3-per-cent. boric acid solution and leave it in.

GENERAL TREATMENT.

In all cases of prostatic hypertrophy **hygienic measures** are very important in preventing attacks of retention of urine. The patient should wear flannel underclothing in winter, and as the circulation of blood is poor in the feet and these parts are most easily chilled, woolen stockings should be worn.

He should avoid any overindulgence in alcohol or malt liquors, although a glass or two of claret or a little whiskey may be permitted.

The bowels ought to receive due attention, and constipation should be guarded against. Any overdistension of the bladder with retained urine has the effect of still further weakening the atonic muscular walls, and on this account the patient should be instructed to pass his water at regular intervals, two to four hours apart.

In the early stages of prostatic hypertrophy, when the enlargement is only moderate in size and not very dense, and when the quantity of residual urine is small, the chief source of annoyance to the patient is from the irritability of the bladder, which causes a frequent desire to urinate.

Such cases are often benefited by the passage of a **large-sized steel sound,** which relieves the irritability of the bladder and overcomes the muscular spasm of the urethra. The action of the sound is to press out and empty the engorged venous plexus around the prostate, and while it does not prevent the increase in size of the gland, it seems at least to retard its growth. The sound should be used once in every five days, and allowed to remain lying in the urethra from ten to fifteen minutes at a time. The sound also lessens vesical irritability, causes the quantity of residual urine to become less, and modifies favorably the whole course of the case.

The treatment with sounds is only applicable to patients who have a slightly enlarged prostate of moderate density, which does not obstruct a catheter and where but little residual urine is present. The prominent symptom of which these individuals complain is the necessity for getting up once or twice at night to urinate.

R. H. Greene advises dilatations of the posterior urethra by means of Kollmann's four-bladed dilator in the early stages of prostatic hypertrophy, with the object of breaking up the submucous infiltration caused by the prolonged urethritis. In this way the mouths of the prostate ducts are freed and the glandular secretion is afforded a means of exit.

The presence of **residual urine** offers an important indication for treatment.

If the residual urine is only one or two ounces in quantity and clear in color, it is only necessary to pass the catheter once in four to eight weeks, in order to observe the progress of the case and ascertain that the obstruction is not becoming greater or the atony of the bladder-wall increasing.

In time, however, the residual urine increases in amount, and when it reaches three or four ounces in quantity, the catheter should be employed once a day to remove it from the bladder, a convenient working rule (if the urine is sterile) being to use the catheter once daily, preferably at bed-time, for three ounces, twice daily for six ounces, and then once more for every additional two ounces. With sterile urine it is rarely necessary to catheterize oftener than once in four hours.

Unfortunately, however, the bladder rarely escapes infection for any length of time after beginning catheterization, and then a new element is introduced into the case: that of **cystitis.** Inflammation of the bladder is generally ushered in by some rise in temperature, which may run for a few days and subside, or may continue for some length of time as a result of absorption of septic material into the blood.

The frequency of the desire to urinate is notably increased, and the urine contains pus, and in the early stages blood may be present.

The fermentative changes in the urine rapidly cause its decomposition, and it becomes strongly alkaline in reaction and ammoniacal in order.

After cystitis has lasted for a short time the contractility of the muscular fibres of the bladder-walls is still more impaired, and the residual urine increases in quantity, so that the catheter has to be used more frequently, in order to prevent the accumulation of urine, which is stagnant and soon decomposes.

The indications for the treatment of this condition may be summed up as follows:—

(*a*) Drain the bladder of residual urine.

(*b*) Keep it as clean and aseptic as possible, and check decomposition of the urine by means of bladder-washing and the administration of urinary antiseptics by the mouth.

For the treatment of the cystitis the reader is referred to the chapter on the treatment of "Chronic Cystitis."

The ordinary routine treatment of a case of prostatic hypertrophy, consisting in **bladder-washing and daily catheterization**, can be readily carried out by the patient himself, if he is moderately intelligent, after he has been instructed by his attending physician.

The best form of catheter for him to use is the soft-rubber instrument, and indeed, every patient with enlarged prostate should be familiar with the method of passing the catheter and should keep one at hand, as he is always liable to an attack of retention of urine from some slight cause, and unless prompt relief can be obtained the bladder-wall may suffer irreparable damage from the distension and stretching caused by the accumulation of urine.

An important part of the instruction of the patient consists in teaching him the proper method for the **care of the catheter.** This is a very material point in the management of the case, and, if cystitis is not already established, the frequent use of the catheter generally induces it, unless the greatest care to avoid infection is taken by means of scrupulous cleanliness.

It is not difficult to cleanse the outside of the catheter, but the interior is its most dangerous part, on account of the difficulty of disinfecting it. (See chapter on "Care of Urethral Instruments.")

In every case the catheter should be frequently inspected, and discarded at once when it becomes dry and cracked.

At the time the patient is instructed as to taking care of his catheter he should also be taught to wash the glans penis with a cotton sponge and soap and water, every time before the catheter is introduced, in order to avoid carrying micro-organisms into the urethra from the head of the penis.

But in spite of all precautions, it is most exceptional for the urine to remain clear, and as a rule, a slight degree of cystitis is continually present. On this account and to lessen the tendency to the formation of calculus, it is very desirable that the patient should use **irrigation of the bladder** once or twice each day.

This can be very readily done, at the time he uses the catheter, by means of a rubber douche-bag or fountain-syringe raised up three feet high and attached by its tube to the end of the catheter. The mild solutions, either boric acid, salt solution, or permanganate of potash, or oxycyanat of mercury are suitable for this purpose.

Commencement of Catheter-life.—In cases of prostatic hypertrophy where there is little or no cystitis and the quantity of residual urine is only from four to six ounces, if due precautions are taken to guard against cystitis, the patient very soon becomes accustomed to the use of the catheter. But, in those instances where the residual urine amounts to ten ounces or more, a considerable amount of *constitutional disturbance* usually follows the first catheterization. Urinary fever generally occurs, and, if the kidneys were previously diseased and the patient is very old and feeble, it is by no means rare for the case to terminate by death.

It is desirable, then, before beginning catheterization, in the presence of *large quantities* of *residual urine*, to warn the patient that there is some risk attached to the procedure, and to insist that he shall remain quietly at his home and for the most part in bed for a fortnight. During that time the urine should be drawn by the catheter three or four times a day and from four to six ounces of boric-acid solution thrown into the bladder each time that the urine is withdrawn, so that the bladder will not be left entirely empty.

Urinary antiseptics should be given by the mouth, but it is better to avoid washing out the bladder for the first week or so, until a certain degree of tolerance is established. Under these precautions the advanced cases of prostatic hypertrophy with an excess of residual urine, are introduced into catheter-life with a minimum degree of risk. But even in spite of all care patients who are old and feeble, and are suffering from chronic Bright's disease or pyelitis, sometimes develop a chronic form of urinary fever, induced by the beginning of catheter-life, which terminates fatally.

In these instances death would have resulted from the kidney disease in any case, after a short time, and had the use of the catheter been commenced at an earlier period in the disease, the secondary involvement of the kidneys would have been avoided.

Retention of Urine.—Most old men with enlarged prostates suffer at some time in their lives with an attack of acute retention of urine, from spasm of the cut-off muscle and swelling of the mucous membrane at the vesical outlet. Such a condition calls for *prompt catheterization.* The use of prolonged hot baths and a full dose of opium, which so often relieves a spasmodic stricture in a young man, is not to be recommended in retention of urine from an enlarged prostate. The overdistension of the bladder must be relieved at once, as the stretching of its muscular fibres induces a condition of atony.

The form of *catheter* to be selected depends upon the shape which the overgrown prostate has assumed. It is often found impossible to introduce a flexible soft-rubber catheter, and it is necessary to try various shapes, until one is found which will override the obstruction offered by an enlarged middle lobe, or an adenomatous tumor which deflects the urethra to one side.

The form of catheter which is most frequently serviceable is the *Mercier catheter,* with the end turned up (coudé). The angled end usually slips up past an enlarged middle lobe and enters the bladder. The catheter bicoudé acts in a similar manner and is useful when the overgrowth of the middle lobe is excessive.

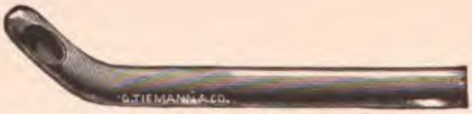

Fig. 115.—Mercier Catheter Coudé.

The *silver prostatic catheter,* with a long beak and an exaggerated curve, is especially designed to fit the elongated sweep of the urethra distorted by the prostatic overgrowth, and is frequently successful in reaching the bladder. When it fails to enter the bladder the following manipulation is often successful: The surgeon has provided himself beforehand with a common English catheter with a stylet, which has been previously prepared by giving it an exaggerated curve, and it is then laid away until needed. When it is wanted, the stylet is withdrawn and the catheter is introduced into the urethra. The warmth of the body causes the curve to increase, and the point of the instrument overrides the obstruction. The catheter may also be introduced with the stylet in it down to the prostatic urethra. When it reaches this point the stylet is withdrawn and the point of the instrument curves around the enlarged prostate.

In the manipulations with the silver and English catheters due care should be used not to make a *false passage* in the swollen tissues around the prostate. The attempts to reach the bladder with a filiform guide and a tunneled sound threaded over it are of very little use except in cases of stricture.

A bladder which is full and distended, if it has been so for more than a few hours, should *never be completely emptied at one sitting*, but six or eight ounces of urine or 3-per-cent. boric-acid solution should be left in it, to support the blood-vessels and give the muscles something to contract on.

If all attempts to enter the bladder are unavailing, in order to relieve the retention it is necessary to have recourse to **suprapubic aspiration of the bladder.**

The needle attached to the aspirator is thrust directly downward, a finger's breadth above the pubes, and penetrates the bladder without wounding the peritoneum, as when the bladder is distended the fold of peritoneum covering it, is raised up two and one-half inches above the pubes.

Aspiration affords prompt relief; but, while the bladder has been emptied for the space of a week by means of repeated aspirations, it cannot be done with safety more than a few times.

Suppuration often results after three or four tappings, or the bladder-wall becomes soft and leaks; so that aspiration can only be depended on as a temporary expedient, for a day or two.

In certain cases of enlarged prostate, which are suffering from chronic retention, it is desirable to keep the bladder empty and at the same time avoid the frequent introduction of a catheter; to attain this end **continuous catheterization** is accomplished by introducing a soft-rubber catheter into the bladder and tying it, so that it cannot be forced out.

The indications for the use of continuous catheterization are summarized by J. W. White as follows:—

(*a*) When great difficulty is experienced in introducing the catheter.

(*b*) When much bleeding follows the introduction of the catheter, as is generally the case when unsuccessful attempts at catheterization have been made before.

(*c*) When much cystitis with purulent or ammoniacal urine exists and the frequent passage of a catheter is impracticable on account of the pain and hæmorrhage which it produces.

By means of continuous catheterization, the bladder is drained and readily washed out, and a general improvement in the symptoms takes place.

A metal catheter should, of course, never be left in the bladder, for a sudden motion of the patient may force the end through the bladder-wall. Such a wound is followed by leakage of urine, peritonitis, and death.

An ordinary soft-rubber catheter may be tied in the bladder, or the Pezzer catheter may be employed with advantage, as it is not easily withdrawn, except intentionally, and the spreading end holds it in place without the necessity of tying it fast.

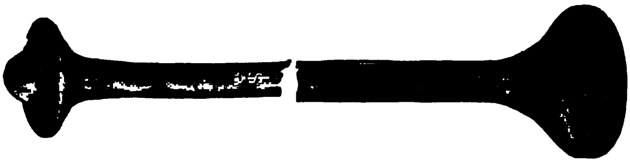

Fig. 116.—Pezzer Catheter.

In order to introduce the catheter, a stylet is passed through its lumen, straightening out the mushroom-shaped dilatation at the end. When the catheter is in the bladder the stylet is withdrawn, and the mushroom expansion reappears, and by its projection holds the catheter in place.

CHAPTER XIV.

OPERATIVE TREATMENT OF HYPERTROPHIED PROSTATE.

THE removal of the obstruction offered by an enlarged prostate, by means of a surgical operation, is not to be thought of in patients who have but a small quantity of residual urine and little or no cystitis, and when catheterization is easy and not accompanied by pain or bleeding. In many instances the patient can be made entirely comfortable throughout his life by regular catheterization.

In many cases, however, when the catheter has been used for a long time, the prostatic hypertrophy increases in size, the contractile power of the bladder lessens, the cystitis grows worse, and the presence of a small quantity of urine in the bladder causes extreme tenesmus until it is removed. As a result of the frequent demands for urination, the catheter has to be passed so often that the urethra becomes irritable and bleeds freely, and the cystitis grows progressively worse. In the expressive words of J. W. White, the condition of the patient is that of "approaching breakdown in catheter-life." These are all indications that catheterization must be discontinued and some other means of draining the bladder adopted.

Indeed, all of the surgical operations for prostatic hypertrophy are directed to the one end of *draining the bladder,* either through the removal of the obstructing portion of the prostate or by means of an artificial permanent fistula.

The improvements in the technique of operations on the prostate have resulted in such a lowering of the death-rate, that surgeons feel justified in performing a radical operation at an earlier period than formerly. The early operation is advised with the view of preventing infection of the kidneys and the deterioration of the patient's general health, on account of absorption from a septic bladder and the broken rest at night attendant upon frequent calls to urinate.

The prognosis of an operation is much better if done upon a man in good general health at the age of sixty, than upon the same patient ten years later, after he has been worn out with suffering, and who has, in addition, diseased kidneys.

Until within a very recent time the operative treatment of hypertrophied prostate was in the experimental stage, as may be seen by the accompanying table of operations in vogue.

A list of the operations may be tabulated as follows:—

Radical Operations.—

Bottini's Operation.
Prostatotomy { Perineal. Suprapubic.
Prostatectomy { Suprapubic, Perineal, or Combination of both.
Vasectomy.
Castration, or Orchidectomy.

Palliative operations, in which no part of the prostate is removed, are only undertaken for the purpose of draining the bladder, through a fistulous opening:—

(*a*) Perineal cystotomy and drainage through a catheter retained in the bladder.

(*b*) Suprapubic cystotomy.

(*c*) Puncture through the substance of the prostate with a trocar.

HISTORY OF OPERATIONS ON THE PROSTATE.

In order to understand clearly the present status of the surgery of the prostate, it is necessary to go back and study its gradual growth.

The operation of **perineal prostatectomy,** which is to-day considered by most genito-urinary surgeons to be the one of choice, was not evolved in a night, but was a thing of slow development, each observer adding something to the sum of our knowledge.

The earliest attempt at operative interference with the prostate was a simple incision, or *prostatomy,* through the perineum, in which a middle lobe was divided in halves, or a V-shaped piece was cut from the prostate in order to get a low-level channel from the bladder.

It was found that when the prostate was not more than three inches thick, it was possible to reach a projecting median lobe through an incision in the perineum.

Once within reach, the lobe could be readily divided with a knife, or if it was nipple-shaped, it could be nipped off with scissors or an ecraseur.

It was, however, found to be rarely possible by means of a simple prostatotomy to remove enough of the overgrowth of prostatic tissue to relieve the symptoms of obstruction, and the chief advantage which followed was from the benefit the patient derived from the prolonged drainage of the bladder through a catheter and the consequent improvement of the cystitis.

In 1888 a great impetus was given to prostatic surgery by two operations of McGill, of Leeds, England, who removed, through a suprapubic incision, portions of the prostate. These growths were chiefly intravesical projections, and were removed by cutting with scissors and tearing off with forceps. The suprapubic wound was subsequently utilized for bladder drainage.

In 1890, Belfield, of Chicago, advanced the technique of prostatectomy by operating through a *combination of suprapubic and perineal* incisions.

In this way easier access was afforded to the prostate, and he removed the growths by enucleation, instead of cutting and tearing them off.

In these operations the prostate was enucleated through the suprapubic wound, and the perineal wound was utilized for drainage.

The hæmorrhage was always considerable, and often alarming, and the bleeding could only be controlled by packing not only the cavity in the prostatic capsule, but the bladder as well.

The mortality of suprapubic prostatectomy remained at a very high rate, in the cases reported reaching 20 per cent.; but if all the deaths were known the death-rate would probably be much higher.

Until this time the prostate had always been removed through an incision in the bladder made above the pubes, but surgeons now began, in an experimental way at first, to utilize again the perineal incision for enucleating and removing it.

The practice of making an opening into the bladder above the pubes was still maintained by Alexander, Nicoll, and others, but the opening was merely used for the purpose of introducing two fingers and depressing the prostate so that it could be reached and enucleated from the perineum.

At the present time of writing, the feeling among most genito-urinary surgeons is that the prostate in most cases can be removed with more ease, and with greater safety to the patient's life, through a *perineal incision and without an opening into the bladder.*

It is impossible to practice medicine or surgery on the rigid lines of an unvarying routine, for every case is a law unto itself, and unusual conditions demand unusual measures.

Occasionally a large vesical calculus or a high degree of intravesical growth, or some other irregularity, may require an opening into the bladder, with perhaps complete enucleation through the suprapubic wound.

And it is only fair to say that some genito-urinary surgeons (Eugene Fuller, Freyer, and others), from a long and successful experience with suprapubic prostatectomy, regard it as the operation of choice in every case.

An objection, which was urged, in the beginning, to the removal of the prostate through a perineal incision, was the fact that in many cases the upper border of the prostate was so distant that it could not be reached by the finger, and could not be held immovable while being shelled out of its capsule.

This difficulty has been overcome by various mechanical devices, such as Murphy's hooked retractors, Parker Syms's rubber balloon retractor, and Young's prostatic retractors. They are useful instruments, and in practiced hands answer the purpose for which they were intended, but in most cases can be dispensed with.

The former high rate of mortality in prostatectomy led surgeons to seek for other means of removing the obstructing prostate.

In 1893 J. William White, of Philadelphia, first published the results of his experiments, showing that the removal of both testicles in animals caused an atrophy and shrinking of the prostate, and in the same year Ramm, of Christiania, reported similar results.

Velpeau and Sir Henry Thompson called attention, years ago, to the similarity between the fibromyomata occurring in the prostate and those of the uterus. Following up this suggestion, White castrated a number of dogs, and found that the operation was in every case followed by a rapid atrophy, first of the glandular structures of the prostate and then of the muscular elements.

Since then it has been frequently demonstrated that while **double castration** causes an atrophy of the prostate in animals, it does not cause a reduction in the size of the tumors which occur in hypertrophied prostate in men. It does, however, occasion a decrease in the congestion of the gland, and in this way the urinary obstruction was temporarily relieved in some cases. For a time the operation had a good deal of popularity, but to-day it is no longer in use and has been abandoned.

At the time castration was practiced, the disinclination of patients to allow the removal of their testicles led surgeons to attempt to cause an atrophy of the prostate by means of **vasectomy**, or ligating the spermatic cord through an incision in the scrotum.

Experiments on animals show that, when the spermatic cord is divided, the prostate sometimes grows smaller. The decrease in size is accounted for by a lessening of the congested condition of the gland which takes place immediately after the operation.

Albarran and Motz, from their studies of the subject of vasectomy, conclude that resection of the vasa deferentia is often followed by a lessening of the congestion of the prostate, which causes its volume to diminish temporarily, and evokes an improvement of the dysuria, the cystitis, or the retention, from which the patient suffers.

There is nothing to prove that the operation causes an atrophy of the hypertrophied prostate, or that in cases of chronic incomplete retention of the residual urine is diminished, if the operation is made at a time when the prostate is not congested. There are also no records to show that after the operation the bladder is able to empty itself.

Casper[1] believes vasectomy may be useful in two classes of cases:—

(*a*) In old men who are dependent on the catheter and who are subject to repeated attacks of epididymitis.

(*b*) In patients with slightly contracted bladders and no residual urine, but who suffer from an uncontrollable, constant, and severe tenesmus.

Casper accounts for its beneficial effects in these cases, not by reducing the size of the prostate, but by severing the nerves of the vas deferens, which are in an irritable condition.

Except in such cases as just mentioned, vasectomy has been abandoned, and the only operations in use to-day for the radical cure of hypertrophied prostate consist in **prostatectomy** (perineal is the form advised by the majority of surgeons) and **Bottini's operation.**

PERINEAL PROSTATECTOMY.

Preliminary Treatment.—Before every operation for the removal of the prostate, it is very important to institute a course of preliminary treatment for from one to three weeks, for the purpose of improving the condition of the bladder and cleaning out the intestinal canal.

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[1] Lehrbuch der Urologie, 1903.

As the deaths following prostatectomy nearly always occur from septic anuria, caused by the infection of the wound with septic urine and subsequent shutting off the kidney secretion, too much stress cannot be laid upon the importance of getting the urine in good condition before operation.

The patient should be kept quiet in his room, most of the time in bed, the bowels freely opened with calomel, and kept open with salts.

A light diet, consisting chiefly of milk and cereals, and large quantities of pure spring-water as a beverage, should be ordered, to render the urine bland.

Urotropin, grs. viiss. t. i. d., should be given internally.

The cystitis which is always marked in every operative case, should be energetically treated by washing the bladder with nitrate-of-silver solution.

Israel advises tying a catheter in the bladder, for the purpose of permanent catheterization, for two or three weeks before the operation.

In exceptional cases, where the bladder is very foul and does not clear up under irrigation, a preliminary suprapubic cystotomy, merely for the purpose of drainage, was highly recommended by Bryson.

TECHNIQUE OF OPERATION.

Various surgeons have devised different methods of removing the prostate through a perineal incision.

The methods may be grouped under *two* heads:—

Method A.—The method of performing the perineal operation which is generally followed in Germany, France, and to a very considerable extent in this country, may be briefly described as follows:[1]—

The patient is placed in the exaggerated lithotomy position and a staff is introduced into the bladder.

A triangular or curved incision is made across the perineum from one tuber Ischii to the other, with its apex at the bulbous portion of the urethra.

After the skin and fascia are cut through, the attachment of the external sphincter ani to the perineal centre is severed and the dissection is continued posterior to the transverse perineal muscles.

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[1] Deaver, Enlargement of the Prostate, Blakiston, 1905.

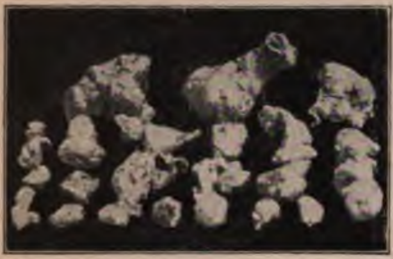

Fig. 117.—Hypertrophied Prostate (adenomatous form) after enucleation by perineal prostatectomy. Weight, 1420 grains. (Author's case.)

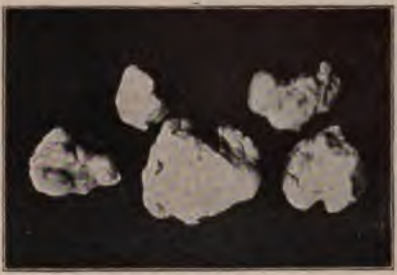

Fig. 118.—Hypertrophied Prostate (adenomatous form) after enucleation by perineal prostatecomy. (Author's case.)

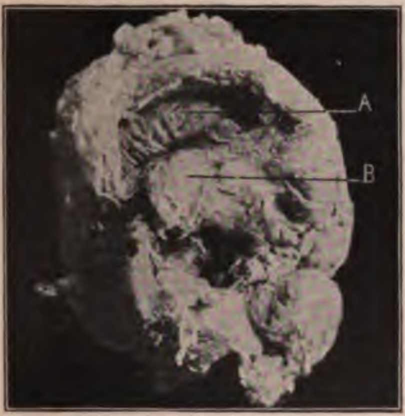

Fig. 119.—Post-mortem specimen of bladder after perineal prostatectomy. (Author's case.)

A. Bladder.

B. Cavity within prostatic capsule formerly occupied by prostate.

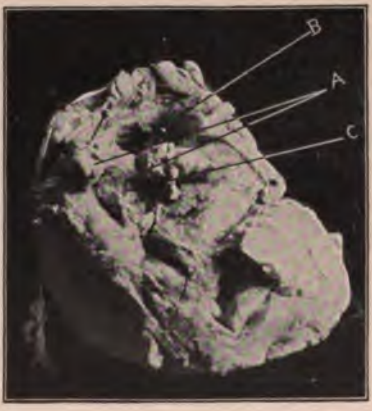

Fig. 120.—Post-mortem specimen of bladder after perineal prostatectomy. (Author's case.)

A. Tags of mucous membrane forming sides of posterior urethra.

B. Bladder.

C. Cavity within capsule formerly occupied by prostate.

The anus is drawn backward, and the recto-urethral muscle is put on the stretch and divided with scissors.

After division of the recto-urethral muscle, the rectum falls away from the anterior structures and the prostate is exposed by separating the tissues with the fingers, in this way opening up the "espace decollable recto-prostatique."

The exposure of the prostate and incision of its capsule are facilitated by placing a large retractor in the lower part of the wound, to hold back the rectum.

After the prostatic capsule is exposed the technique varies with different operators; the usual method, however, is to incise the membranous urethra and introduce some form of prostatic retractor into the bladder to depress and hold firmly the prostate during the enucleation. The retractor of Hugh Young is probably the most serviceable of the various forms.

Two incisions are then made in the capsule of the prostate, on either side of the urethra, leaving a bridge of tissue over the urethra.

The prostate is then shelled out from its capsule with the fingers or by blunt dissection, or dissected out with scissors from either side of the urethra, which remains intact.

After the enucleation of the prostate is completed, the prostatic retractor is withdrawn from the bladder and a large perineal drainage tube is introduced into the bladder through the urethra. The angles of the wound are closed by suture and gauze is firmly packed around the drainage tube.

The after-treatment of the patient is described in full below.

Method B.—An incision is made through the perineum, opening up the posterior urethra. The wall of the urethra is broken through with the finger, which is used to shell out and enucleate the prostate piecemeal.

The prostate is depressed and held firmly during the operation by means of pressure above the pubes or with Syms's balloon retractor.

This method seems to the writer to be the best form of prostatectomy, for the majority of cases, which has as yet been introduced, and was first performed by the late Doctor Bryson, of St. Louis, in 1898,[1] although Gouley, of New York, in 1873, was probably the first one to deliberately formulate a plan for the removal of the entire gland through the perineum.[1]

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[1] Annals of Surgery, November, 1902; St. Louis Medical Review, February 22, 1902.

TECHNIQUE OF BRYSON'S OPERATION.

The patient is placed in the lithotomy position and a grooved staff is introduced into the bladder. An external urethrotomy is done and the knife is carried through the posterior urethra, incising the apex of the prostate.

The fore finger is introduced, exploring the prostatic urethra, and noting the amount of bulging of the prostate at the sides of the posterior urethra, the presence of an enlarged middle lobe, and also if the bladder can be easily reached.

The most prominent portion of the prostatic growth which bulges at the side of the posterior urethra is then found, and the overlying mucous membrane punctured with the finger-nail or a blunt instrument.

The instrument is pushed well into the substance of the gland, and on its withdrawal the right fore finger is introduced, tearing its way into the centre of the mass, which is usually quite friable. The finger is then swept around within the capsule of the prostate, shelling out and enucleating the adenomatous tumors, which are grasped and extracted with a lithotomy forceps. The overgrowths on the opposite side of the prostate are then removed in the same way.

The middle lobe still remains to be dealt with; this is accomplished by sweeping the finger from side to side, working up well behind the bladder and pushing the tumor downward.

After the growths have been removed by the process of enucleation, the bladder should be thoroughly explored with the finger for a calculus.

The oozing, which seems to come from the mucous membrane, soon stops after irrigation of the bladder and wound with hot normal salt solution .

A 34 French soft-rubber catheter is then introduced through the wound into the bladder for the purpose of drainage, and gauze is packed firmly around it, and this pressure absolutely controls the hæmorrhage.

If the field of operation were now examined with the finger, a large cavity would be made out, lying immediately below the vesical outlet, which formerly contained the prostatic tumors, and is only separated from the rectum by a thin wall.

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[1] Watson, Annals of Surgery, June, 1904

The floor of the urethra is generally found to be intact, and the mucous membrane forming the sides of the urethra hangs loosely in flaps, against the outer sides of the cavity from which the growths have been removed.

These flaps, in the subsequent healing, either slough off and disappear, or else become adherent to the walls of the emptied capsule like a skin-graft.

In other cases, where the whole prostate has been shelled out of the capsule en masse, the entire prostatic urethra has disappeared along with the prostate, and the new urethra is formed by a contraction and cicatrization of the walls of the old prostatic capsule.

It was formerly claimed that very large prostates could not be removed through a perineal incision, but it is surprising to find the facility, with which enormous glands can be removed from below, provided an assistant will make firm counter-pressure upon the abdominal wall, just above the pubes, with the fingers of the open hand.

In nearly every case this is sufficient to bring the prostate within reach. In exceptional cases, however, it may be necessary to make a free incision through the abdominal wall, opening up the space of Retzius down to, but not into the bladder.

The bladder may be pushed down within reach and held firmly by two fingers of an assistant, inserted through the incision. (Bryson, 1898; Guiteras, 1901; W. F. Campbell, 1902.)

In exceptional cases, such as a very high grade of intravesical growth, the presence of a large stone, or the escape of a prostatic tumor into the bladder during the process of enucleation, it may be necessary to make a suprapubic opening into the bladder, to facilitate the operation or remove a foreign body.

A suprapubic cystotomy is always to be deprecated and should only be used as a last resort, for it increases materially the shock of the operation and causes increased loss of blood.

A suprapubic wound is always liable to infection, and the convalescence is materially prolonged from its slow healing; the patient also suffers a good deal of annoyance from the unavoidable soaking of the dressings and bed with urine.

Modifications of Perineal Prostatectomy.—While the operation is conducted on the general principles above outlined, the details are somewhat modified by other surgeons.

For many years Alexander practiced, with excellent results, an operation similar to the one described, with the exception that a suprapubic cystotomy was performed for the purpose of holding the prostate firmly and pushing it down within reach, so that it could be enucleated through the perineal wound.

In order to hold the prostate firmly in place, Parker Syms uses a balloon-shaped rubber retractor in the bladder, and while this may be an advantage in exceptional cases, firm pressure by an assistant over the pubes is usually all that is needed.

The *advantages* of Bryson's method of perineal prostatectomy, as compared with other operations, may be summarized as follows:—

I. The comparatively low death-rate.

II. The entire obstructing portions of the prostate are thoroughly removed, without injury to the mucous membrane of the bladder or of the prostatic urethra, above the opening of the seminal ducts.

III. The time required by practiced hands to perform the operation is short (about seven minutes in an ordinary case).

IV. The amounts of hæmorrhage and shock are trifling, as a rule.

V. The most efficient bladder-drainage, with the ability to keep the patient's bed and dressings dry, is attained.

VI. The time of convalescence is short, the patient often sitting up within ten days.

VII. The complete restitution of the bladder function occurs in the majority of cases.

The dangers of the operation are—

I. Suppression of urine in those cases in which there is advanced renal disease.

II. Hæmorrhage, which is rarely serious and can always be controlled by packing the perineal wound with gauze about the drainage-tube.

III. Injury to the rectum. It is, however, only necessary to remember this danger to avoid it.

After-Treatment.—The post-operative treatment of prostatectomy requires the closest attention on the part of surgeons and nurses, for the conditions in the few days after the operation often determine the patient's fate.

Hæmorrhage is not to be feared if the wound has been properly packed. Shock may be marked and should be treated in the usual way. Hypostatic pneumonia should be guarded against by making the patient lie on his side and turning him to the opposite side every two hours. To avoid suppression of urine the patient should drink a tumbler of water every two hours as soon as he has recovered from his anæsthetic. The bladder and perineal wound should be irrigated with oxycyanat of mercury solution, 1 to 4000, twice every day, and in forty-eight hours the packing in the wound must be removed and the wound repacked; and if a stricture in the anterior urethra was divided, a straight sound should be passed down to the perineal tube. At the end of a week the perineal tube may be taken out permanently and the patient allowed to get out of bed and sit in a chair.

About the tenth day a curved sound, No. 30 French, should be passed into the bladder, and this must be done two or three times a week until the perineal wound heals. If this precaution is not taken the granulating surfaces in the prostatic urethra are apt to adhere together and the urethra becomes permanently occluded.

While in many cases it may not be necessary, still it is certainly safer for a sound to be passed at occasional intervals during the rest of the patient's life.

Some idea of the results of perineal prostatectomy may be gained from 66 cases reported by Keyes, Alexander, Morton, Parker Syms, and J. B. Murphy, with the following results: Cured, 80 per cent.; improved, 12 per cent.; died, 7.5 per cent.

Deaver's statistics show 322 cases operated, with 22 deaths, a mortality of 6.83 per cent.

SUPRAPUBIC PROSTATECTOMY.

During the developmental stage of prostatectomy it was the custom for surgeons to enucleate and remove the prostate through a suprapubic incision, and this operation is still preferred by a few men. It may also be required in certain unusual conditions in the bladder, or from the form of the prostatic overgrowth.[1]

The disadvantages of suprapubic enucleation are very decided in the ordinary run of cases.

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[1] Bransford Lewis, Journal of Cutaneous and Genito-urinary Diseases, July, 1902.

There is great liability to lacerate the base of the bladder if the prostate is at all adherent, and the urine soaks through the incision in the trigone and may cause suppuration of the surrounding tissues.

The hæmorrhage is often alarming and difficult to control, frequently requiring packing of the entire cavity of the bladder with gauze; and the shock following a suprapubic cystotomy is always much greater than after a perineal incision.

The suprapubic operation can only be performed when the cavity of the bladder is fairly capacious, for when the bladder-walls are thickened and its cavity very much contracted, this operation is impracticable.

The operation of suprapubic prostatectomy as originally performed by Belfield and McGill has been simplified in certain points by Eugene Fuller.

Technique of Fuller's Operation.—The patient is laid flat upon his back. The Trendelenburg posture is not adopted, nor is Petersen's rectal bag used. The bladder is filled with ten ounces of boric-acid solution, and a rapid suprapubic cystotomy is made.

The location and extent of the prostatic obstruction is determined by examination with the left forefinger. By means of a pair of long-handled scissors, with serrated edges, slipped along the left forefinger as a guide, an incision is made through the mucous membrane of the bladder, which lies above the prostate.

The cut exposes the prostatic tissue, and extends from the margin of the internal vesical opening of the urethra about one and one-half inches in a backward direction. The serrated edges of the scissors prevent any free hæmorrhage from the incision.

Firm counter-pressure is made with the fist against the perineum, and the forefinger of the other hand is slipped through the incision in the bladder-wall, and by means of the finger the entire prostate is enucleated, *en masse* or piece by piece, depending upon the character of the growth.

After the prostate has been entirely enucleated the patient is put in the lithotomy position, an opening is made into the urethra through the perineum, and a large-sized rubber catheter is inserted, through it, into the bladder for purposes of drainage.

Finally, after hot irrigation, the wound in the abdominal wall is partially closed with silk-worm-gut sutures, one of which includes the bladder-wall at the upper angle of the vesical incision and another one passes through the bladder-wall at the lower angle of the wound. In this way the bladder is kept in close apposition with the abdominal wall, so that there may be no leakage into the space of Retzius. A double drainage-tube is inserted into the bladder.

The chief element of success in this operation is the *rapidity* with which it is performed, and it is also essential to use the *smallest quantity of ether* with which anæsthesia can be maintained, on account of the lowered vitality attendant upon the age of the patients.

The results of 77 cases of suprapubic prostatectomy have been tabulated by Socin and Burkhardt, as follows: Cured, 31 per cent.; improved, 40 per cent.; no improvement, 7.8 per cent.; died, 20.8 per cent.

Deaver[1] has collected statistics of 186 cases of suprapubic prostatectomy, in which 20 deaths occurred, a mortality of 10.75 per cent.

Results of Suprapubic and Perineal Prostatectomy.—At the time that the operation of complete removal of the prostate first came into prominence the objection was raised by Guyon, Socin, and Thompson, on theoretical grounds, that, even though the obstructing prostate be removed, the contractile power of the bladder has been so much impaired that the patient will be incapable of spontaneous urination after the operation. The tabulated results of 150 prostatectomies, however, now demonstrate that in 75 per cent. of the cases restoration of the bladder function does take place, and that patients who were previously dependent upon the catheter are enabled to urinate voluntarily again. (Belfield.)

It is only fair to assume that when the obstructing portions of the prostate are completely removed early in the disease, entire restitution of the bladder function may reasonably be expected, provided the operation is done before organic changes in the muscular walls of the bladder, in consequence of a long-standing cystitis, have occurred.

In spite of the good results obtained through prostatectomy, there are several grave objections to the operation. The subjects of enlarged prostate are always advanced in years, and, as a rule, their vitality is at a low ebb. Prostatectomy is a serious operation and attended with a certain amount of shock.

In the days following the operation the patient is exposed to the dangers of ether-pneumonia, to which old people are liable, and to the risks of septicæmia from infiltration of urine into the wound, or uræmic poisoning from a failure of secretion on the part of the kidneys; and pyelitis is very apt to be present if the patient has suffered from urinary obstruction for several years.

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[1] Enlargement of the Prostate, 1905.

To insure restitution of the bladder function by preventing long-standing cystitis, to conserve the general vitality of the patient, and preserve the integrity of the kidneys, it is necessary to operate as soon as catheter life can no longer be maintained.

If the prostatectomy is delayed until the patient's general debility is extreme, the kidneys more or less disorganized, and atheroma very marked, the outlook for his subsequent recovery is very poor, and either Bottini's operation or permanent drainage through a fistula is the only operative procedure which can be undertaken.

BOTTINI'S OPERATION.

Bottini's operation consists in burning channels through the enlarged prostate by means of a specially devised instrument, heated with the electric current, and introduced into the bladder through the urethra. The instrument was devised by Bottini, of Pavia, Italy, and used by him for over thirty years, but never became popular until Freudenberg, of Berlin, made some alterations, which added to its usefulness.

Description of Instrument.—The instrument is shaped like a lithotrite, and is provided with a thin platino-iridium blade, which is concealed when the instrument is closed, and is moved backward or forward in a slot in the shaft by turning a wheel at the end of the instrument. This blade is heated to a white heat by means of an electric current conducted to it from a storage battery, through a cord attached to the extreme end of the instrument. All parts of the instrument, except the blade, are prevented from becoming heated by a stream of cold water, which constantly circulates through it.

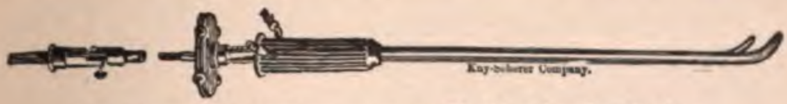

Fig. 121.—Bottini's Instrument, as Modified by Freudenberg.

Technique of Operation.—The operation can be done without a general anæsthetic, simply using a 4-per-cent. solution of cocaine injected into the posterior urethra.

In many cases, however, general anæsthesia is desirable, and nitrous oxide, ether, or spinal anæsthesia may be used, depending on the general indications.

The bladder is first washed with boric-acid solution, and is filled either with the solution or with air before introducing the instrument.

Bottini's instrument is introduced into the bladder and hooked up against the projection of the middle lobe. The cold-water stream is turned on, and when everything is in readiness the electric current is switched on, a pause of ten seconds is made for the blade to become hot, and then the wheel is slowly turned, causing the red-hot blade to slide out of its place of concealment and slowly burn its way through the tissues of the prostate. After the incision has been made deep enough the wheel is reversed, and the blade slid back into its place of concealment, charring for a second time the tissues of the incision, and then the electric current is turned off.

To secure a thorough charring of the tissues the cuts should be made slowly, allowing about ten minutes for each incision.

During the process of burning, the situation of the beak should be watched, by keeping a finger in the patient's rectum.

After the cut through the posterior lobe is made, it is customary to make two others, in an oblique direction posteriorly and to the right and left sides.

The *length of the incisions* depends upon the size of the prostate, but, as a rule, three centimetres are sufficient for the posterior cut and two centimetres for the lateral cuts.

The *after-treatment* consists in keeping the patient in bed for a few days and administering urotropin, gr. viiss t.i.d., or salol, gr. v t.i.d., to sterilize the urine; and strychnine, gr. $^1/_{30}$ q. s. h., if the detrusor muscle is weak or atonic.

Severe tenesmus and desire to urinate are controlled by morphine, gr. $^1/_4$ to $^1/_2$, suppositories.

As retention nearly always follows the operation, either immediately or later, from the swelling of the burned surfaces, Bottini and Freudenberg advise the use of the permanent catheter in preference to passing an instrument; less irritation is caused by the continued presence of the catheter, and there is no danger of tearing open the freshly-burned surfaces.

Bladder-washing is only required in the presence of severe cystitis, and it is not necessary to pass sounds, as the cuts show no tendency to close up. Hæmorrhage is a rare accident, but can be controlled by the presence of a large-sized catheter tied in the bladder.

The sloughs usually separate about the eighth to the fourteenth day, and some slight bleeding occurs; and if the operation has been successful in severing the obstruction the urine begins to flow freely.

The maximum of improvement is not attained, however, until after four weeks have passed, as by that time the bladder has recovered its tone to some degree, and the ciactrices in the prostate, formed by the healing of the incisions, have begun to contract and open up the passage.

Selection of Cases.—Since the development of perineal prostatectomy Bottini's method has been forced into the second place, but still has a field of usefulness in cases to which prostatectomy is not applicable.

As an anæsthetic can be dispensed with, and the operation is accompanied with but little shock and is therefore comparatively free from danger to life, it is particularly adapted to old men who are too debilitated to stand the severe ordeal of a prostatectomy.

Bottini's operation seems peculiarly suitable for the small, hard, fibrous prostates, where there is a decided bar at the neck of the bladder, which are difficult to enucleate.

The large adenomatous prostates, the size of an apple or larger, are better treated by complete enucleation through the perineum, if the patient's general condition will admit of a prostatectomy.

If Bottini's operation is undertaken in these large prostates, it frequently happens that the grooves which are burned are not sufficiently deep to relieve the obstruction.

There are, however, a number of cases of this class reported, where Bottini's operation was followed by improvement.

Among the *contraindications* to Bottini's method may be mentioned a severe cystitis with thick, brown, stinking urine, which demands preliminary treatment before operation.

A mild pyelitis is not regarded as a contraindication, but a severe double-sided pyelitis precludes any operation, as does a high grade of arteriosclerosis or extreme debility.

The value of Bottini's operation is fairly expressed by Casper.[1]

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[1] Lehrbuch der Urologie, 1903.

"Its results are not brilliant, but a few patients are cured and many improved. In selected cases it may be recommended. On the other hand, the danger must not be forgotten, and it should be borne in mind that the success of the operation is entirely uncertain."

Results as shown by statistics collected by Burckhardt,[1] *from patients operated on by Wossidlo, Von Frisch, W. Meyer, Stockmann, Freudenberg, and Emil Burckhardt.*

Number of Cases.	Cured and Improved.	Without Result.	Died.
960	73 to 77 per cent.	14 to 18 per cent.	7 to 10 per cent.

CHETWOOD'S OPERATION.

Chetwood's operation is a modification of Bottini's and consists in burning furrows in the prostate, with a special instrument devised by him, introduced into the bladder through a perineal incision.

Keyes and Chetwood claim for it the advantages of permitting digital examination of the obstructing prostate, the accurate placing of the instrument in position, and subsequent adequate drainage through the perineal incision.

The surgeon undertaking Chetwood's operation can, at any time during its course, convert it into a perineal prostatectomy and enucleate the entire prostate.

PALLIATIVE OPERATIONS.

In these operations no attempt is made to remove any portion of the prostate. They are done for the sole purpose of draining the bladder, treating the cystitis, and avoiding catheterization.

The bladder may be drained by means of a

(*a*) Perineal opening. (*b*) Suprapubic cystotomy.

The perineal incision is the operation of choice when it is desired to drain the bladder *temporarily* for the sake of giving a respite to the urethra which has been irritated by the hourly passage of a catheter, or to remove blood-clots from the bladder which have originated from hæmorrhage into its cavity.

In cases of severe and obstinate cystitis, the perineal opening and continuous drainage serve to clear the bladder from the thick mucopurulent urine and to restore the vesical mucous membrane to a healthy state and the urine to its normal *acid* reaction.

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[1] Socin and Burkhardt. Die Verletzungen und Krankheiten der Prostaten, 1902.

The perineal incision is a less serious operation than suprapubic cystotomy; the danger to life is not as great, and an opportunity is also offered to search the bladder with the finger, and if a small stone is found, it can be removed.

The prostatic urethra is stretched and dilated with the finger at the same time, and a large catheter is introduced through the wound and kept in the bladder for from one to three weeks, draining it of its residual urine and allowing it to be washed out and kept clean and aseptic.

The drainage of the bladder gives great comfort. The patient is not aroused from sleep every few minutes to pass water. The tenesmus and pain on urination are no longer felt, the cystitis subsides, and the prostatic œdema lessens. Sometimes spontaneous urination follows. After the drainage is discontinued the introduction of a catheter becomes easy.

Unfortunately, however, drainage through the perineum cannot be kept up indefinitely. The posterior urethra becomes irritated and resents the presence of the catheter after a few days, and so much pain and spasm are caused by it that the catheter has to be removed.

In such cases, when the drainage is still required, we must have recourse to another mode of accomplishing it: *i.e.,*

Suprapubic Cystotomy.—An opening made into the bladder above the pubes gives an opportunity to inspect the cavity of the bladder and remove a calculus if present, and if the stone happens to be in a saccular dilatation it can never be found in any other way.

As the condition of these patients is always desperate, and the operation is only undertaken as a last resource, it is important to avoid giving a general anæsthetic, if possible.

Rovsing[1] therefore uses local anæsthesia, by means of cocaine solution injected under the skin over the bladder, which gives enough insensitiveness for the purposes of the operation.

The suprapubic fistula answers very well as a permanent opening and is more easily managed by the patient than the perineal opening. A Pezzer catheter, No. 25 French, is arranged to pass through the fistula, in the abdominal wall, into the bladder, siphon off the urine, and allow it to flow into a reservoir under the clothing. The patient wearing such an apparatus is able to be up and about, even to take long walks and enjoy a fair amount of activity.

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[1] Archiv fur Klinische Chirurgie, iv Hft., 1902.

CHOICE OF OPERATION IN HYPERTROPHIED PROSTATE.

In the last few years the rapid advance of prostatic surgery enables us to select with a fair degree of accuracy the particular form of operation which is most suitable for a given case.

There are two views held with regard to the question *as to the time of operation.*

A few surgeons advise operation as soon as symptoms of obstruction begin to appear, with the view of preventing infection of the bladder and causing pyelitis, and conserving the patient's general strength.

Conservative genito-urinary surgeons, however, are of the opinion that it is better to allow the patient to use the catheter as long as he is made comfortable by it; and when the time comes that the catheter fails to relieve, an operation to remove the obstruction offered by the prostate is demanded.

In many cases the patient is enabled to live comfortably for years by means of the catheter.

These individuals, however, should always be kept under close observation; and when it is evident that the catheter is no longer adequate, an operation, preferably perineal prostatectomy, is called for.

The opinion of the genito-urinary surgeons on this point is well expressed by Paul Thorndike:—[1]

The conclusions which he formulates are: (1) No prostatic should be allowed to suffer from lack of proper treatment. (2) There is still a place for the catheter in such treatment, and many patients can be made comfortable and can be kept so by its systematic and proper use. (3) All those who cannot be kept comfortable by palliative measures are fit subjects for some operation. (4) An operation is indicated immediately the inadequacy of palliative treatment becomes apparent. (5) The operation of choice is always prostatectomy, but patients over sixty or sixty-five years of age are rarely, owing to their lowered general condition, suitable objects for such a radical procedure. (6) To such as are not fit subjects for prostatectomy, the Bottini operation may be offered as one attended with but little risk to life, followed by a short convalescence, and offering a fair promise of such a degree of improvement as will at least obviate any further necessity for the systematic use of the catheter.

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[1] Boston Medical and Surgical Journal, August 13, 1903.

There are certain conditions which differ in each individual, and which have to be carefully considered before selecting the operation which seems most applicable to the case in hand.

POINTS FOR CONSIDERATION.

I. General Conditions.—(*a*) The age of the patient.

(*b*) The state of his general health.

(*c*) The condition of his sexual powers.

(*d*) The state of his kidneys.

(*e*) The amount of atheroma in the arteries.

II. Condition of the Prostate and Bladder.—(*a*) The size and density of the prostate.

(*b*) The form of the obstruction: whether it is in the form of a bar across the vesical outlet, a tumor deflecting the urethra, or a mass the size of an orange filling up the pelvis.

(*c*) The condition of the bladder in relation to its atony or hypertrophy.

(*d*) The quantity of residual urine.

(*e*) Catheterization, its ease, or if attended with pain and bleeding, and its necessary frequency.

(*f*) The severity of the accompanying cystitis.

III. Complicating Conditions.—(*a*) Vesical calculus.

(*b*) Stricture.

(*c*) Diabetes.

For the better selection of an operation it is useful to adopt the classification of prostatic cases suggested by J. William White.

Class A.—Patients with moderate enlargement of the prostate, who suffer little or no pain, and with clear residual urine to the extent of three or four ounces. For these cases no operation is to be thought of, and they get on very well with methodic catheterism. But in time, as these difficulties increase, they come into Class B.

Class B.—These patients suffer with marked obstruction from the prostatic overgrowth at the vesical outlet. The prostate ranges in size from one and one-half inches in diameter to three inches (about the size of a lemon). The residual urine may be eight or ten ounces in amount, or there may be complete retention. The

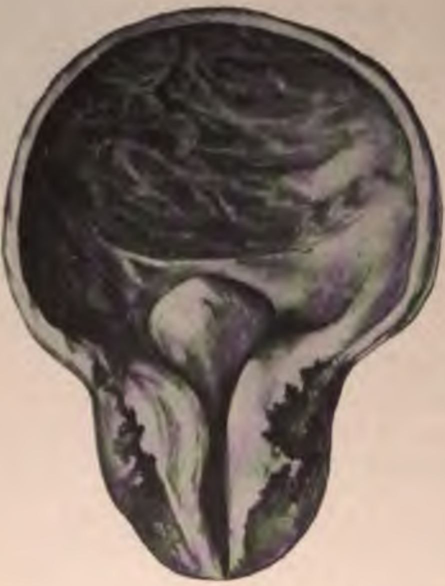

Fig. 122.—Prostatic Hypertrophy. Bilateral enlargement, but no obstruction from that source; intravesical globular tumor, pedunculated, which obstructs in ball-and-socket-valve manner. Bottini inappropriate; suprapubic removal the operation of choice. (Bransford Lewis.)

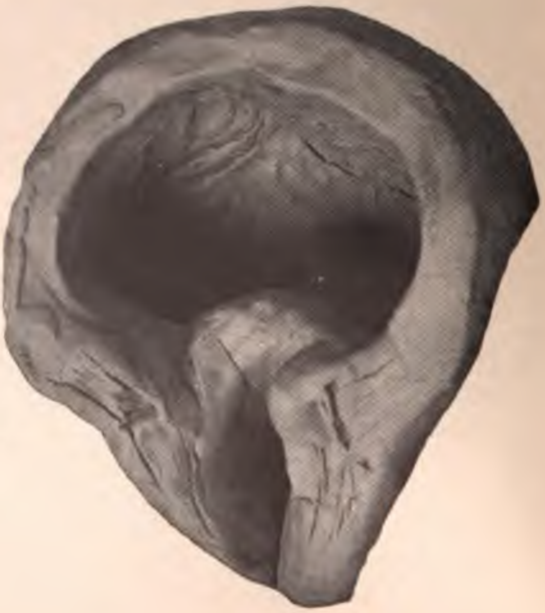

Fig. 123. — Prostatic Hypertrophy. Moderate enlargement of both lateral lobes; thick, dense prostatic bar; deep bas fond; marked curvature of narrow prostatic urethra. Favorable for perineal prostatectomy; Bottini questionable. (Bransford Lewis.)

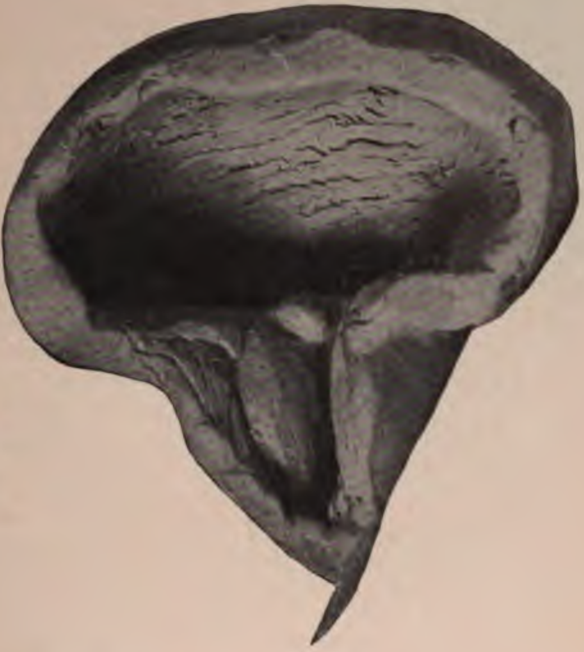

Fig. 124.—Prostatic Hypertrophy. Considerable enlargement of both lateral lobes, but especially of the right; high prostatic bar; small nodule on right of the bar; deep bas fond. Favorable for Bottini, or for perineal prostatectomy. (Bransford Lewis.)

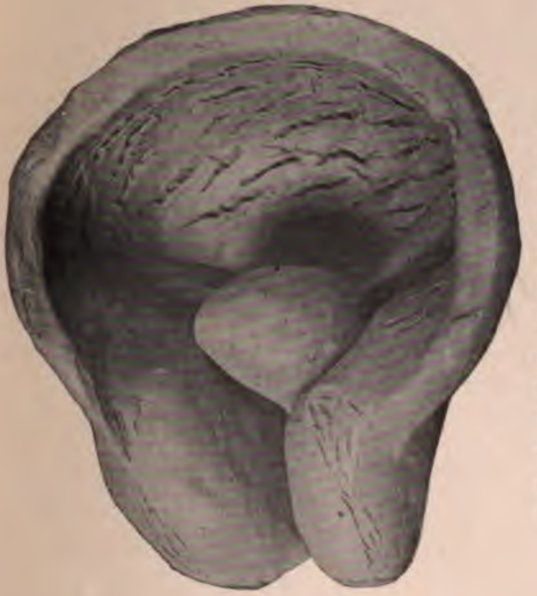

Fig. 125. — Prostatic Hypertrophy. Marked enlargement of both lateral lobes, and globular intravesicular tumor from posterior commissure. Removal of tumor and both lobes required; best accomplished through perineal and, possibly, suprapubic combined routes. Bottini inappropriate and inadequate. (Bransford Lewis.)

cystitis is marked, and the urine is purulent, ammoniacal, and fœtid, and operative interference of some kind is clearly indicated.

If the patient is strong and vigorous, with active sexual powers, free from atheroma, with sound kidneys, and if the hypertrophy is glandular in character, causing the prostate to be soft and elastic and of large size, perineal prostatectomy is the operation of choice, and is followed in the great majority of cases by complete restitution of the bladder function.

The risk to life, for patients in good general condition is very small, for in the mortality records of *all* cases, including unfavorable risks and desperate cases, the death rate is only about .08 per cent.

Class C.—In this class the patient is old and very feeble, with marked atheroma and diseased kidneys. The prostate may range from two inches in diameter to the size of a small orange. Retention of urine is nearly or quite complete, and catheterization is difficult and painful.

Prostatectomy, while very much more dangerous than in Class B, might still be undertaken with some hopes of success; but Bottini's operation would here probably be the operation of choice, as it can be done without an anæsthetic and is attended with less shock than prostatectomy.

Class D includes the desperate cases with enormous prostates and excessive cystitis. The bladder is dilated and saccular, the retention complete, and catheterism difficult. These patients are advanced in years, and suffer from chronic urinary fever. The kidneys are diseased, and atheroma is extreme. Any surgical operation is attended with great danger, but the patients' suffering is so great that they are willing to accept any risk for the sake of relief.

In these cases the only operation which could be endured, would be the establishment of permanent drainage of the bladder through a suprapubic fistula, under local anæsthesia.

Diabetes is regarded as debarring all operations unless catheterization is impossible. In such cases permanent drainage through a suprapubic fistula affords the best means of relief.

CHAPTER XV.

TUBERCULOSIS OF THE PROSTATE.

THE prostate is involved in nearly every case of genito-urinary tuberculosis. Of 26 cases of tuberculosis of the prostate reported by Socin, in 24 of them other genito-urinary organs were affected and only in 2 did the genito-urinary apparatus escape. In these two instances the lungs and bones were the seat of tubercular deposits.

Although Sir Henry Thompson denied that the prostate could ever be the seat of *primary tuberculosis,* later investigators have proved conclusively that it may be, and Desnos and Krzwicki even go so far as to state that, in their opinion, in most cases of genito-urinary tuberculosis the prostate is the organ which is first infected with tubercle bacilli, and from that focus the infection subsequently travels to the adjacent structures. This point is important to bear in mind in connection with the operative treatment, which will be considered later.

The *time of life* at which tuberculosis is most apt to fasten upon the genital organs, is that period at which sexual activity is most highly developed, and consequently we find that our patients are usually between twenty and forty-five years of age.

Predisposing causes play an important rôle in the etiology of tuberculosis of the prostate. Anything which induces prolonged and oft-repeated congestion of the posterior urethra weakens the resistance of the tissues; consequently a tubercular outbreak is more liable to occur in the person of a young man who has practiced some form of sexual abuse or has been the subject of a prolonged attack of gonorrhœa of the posterior urethra. But this in itself is not sufficient to cause the disease, and to bring this about the tubercle bacilli must be actually introduced into and develop in the substance of the gland.

As to the **modes of infection,** the micro-organisms are most frequently brought to the prostate in the blood-circulation, often from a tubercular deposit in some distant organ. In other cases they may be taken into the body through the respiratory or alimentary tracts, and, passing along with the blood-current, be ultimately deposited in the prostate.

The inoculation of bacilli, however, may be direct, and be occasioned by an infected catheter or through coitus with a tubercular female, or the prostate may be infected by a process of extension from some neighboring organ.

PATHOLOGY.

A tuberculous deposit takes place in the substance of the prostate, and either one or both lobes are affected. The tubercular nodules are multiple from the beginning, or else soon become so, and they enlarge until several coalesce, when they break down and form abscesses.

Unless removed by operation, the pus bursts through into the rectum or urethra or even the hypogastrium, and multiple fistulous tracts are formed. In rare instances the cheesy mass becomes the seat of calcareous changes, or the fluid portion of the mass is absorbed and the residue is encapsulated, and a healing of the lesion results.

It is important to note that the bladder and seminal vesicles are always involved sooner or later in the course of the disease. The epididymis is also affected, although in many cases this organ is the first attacked, and the infection extends to the prostate subsequently.

SYMPTOMS AND COURSE.

If the process begins in the central part of the prostate, no definite symptoms are caused; but if the nodules are located superficially, and cause a bulging of the prostate toward the rectum, a sense of weight in the perineum and difficulty in defecating is experienced.

If, on the other hand, the tubercular foci lie close to the urethra, the symptoms are those of posterior urethritis, viz.: frequent and urgent urination, accompanied by a muco-purulent discharge from the urethra and shreds in the urine.

There is no distinct pain after the act of micturition, but a feeling as though the bladder were not fully emptied.

Defecation spermatorrhœa sometimes occurs if the deeper-lying prostatic tubules are infiltrated with nodules. Another form of secretion from the meatus is occasioned by the breaking down and discharge of small abscesses through the urethra.

Hæmaturia is a frequent symptom, and is not constant, but intermittent. The blood comes at the end of urination, and is not due to an ulceration of the urethra, as formerly supposed, but merely to the congestion of the prostate.

In uncomplicated cases *pain* may be excruciating, and is sometimes so severe that it overshadows all the other symptoms.

As the disease progresses the bladder is always affected. This is announced by the occurrence of pain after urination and tenesmus, and as the cystitis grows worse, the bladder symptoms become the marked feature in the case.

In most cases of tuberculous prostatitis death is caused by an ascending infection, involving first the bladder and subsequently the kidneys, or the lungs may be attacked, or a general miliary tuberculosis may be established.

In a few rare instances the disease remains limited to the prostate; an abscess forms, which breaks and discharges, the cavity cicatrizes, and a cure follows.

DIAGNOSIS.

On rectal examination the tubercular prostate will be found enlarged in one or both lobes. The enlargement is distinctly nodular or lumpy, and at first of a stony hardness. After the abscess forms points of softening with fluctuation can be readily felt.

It is often extremely difficult, indeed sometimes impossible, to determine whether the enlargement is in the prostate or involves the seminal vesicles, for these different organs may be so blended together by the inflammatory exudation that the lines of demarcation cannot be defined. On this account it was formerly supposed that every tubercular process in this region was confined to the prostate, whereas we now know it to be true that the tubercular process may attack prostate and vesicles together, or either organ be involved alone.

The gonorrhœal inflammations of the prostate, chronic prostatitis, or the acute suppurative form resembles in physical signs the tuberculous disease, and it is impossible definitely to establish the diagnosis of tuberculosis until the presence of tubercle bacilli has been demonstrated in the secretions. These may be collected by expressing, with the finger in the rectum, the secretions from the prostate gland; and the bacilli are also generally present in the discharge from the meatus which so often exists.

If no tubercle bacilli are found in examining the secretions, guinea-pigs may be inoculated with the discharges, and, if the pig develops tuberculosis, the diagnosis is, of course, established.

In cases of general tuberculosis it is usually safe to consider every enlargement of the prostate tubercular in character, and the only difficulty in diagnosis arises in the cases where the prostate is the seat of primary tuberculosis.

PROGNOSIS.

The prognosis is, of course, of the gravest, although when the tuberculosis is limited to the prostate alone spontaneous cure sometimes occurs through healing of the cavity after the abscess has formed and burst.

Unfavorable elements in the case are an hereditary predisposition to tuberculosis and a tendency for the disease to extend and involve other organs.

TREATMENT.

The general treatment consists in endeavoring to vitalize the tissues by means of a life in the open air or a prolonged sea-voyage, abundance of nourishing food, and the administration of codliver-oil, creasote, guaiacol, and other antitubercular remedies.

There is a difference of opinion as to the advisability of beginning local treatment early. In general, it is better to avoid instrumentation, for the reason that the local resistance of the tissues is reduced, and infection of the bladder with other micro-organisms readily occurs.

On the other hand, instillations into the posterior urethra in the early stages have their advocates. Guyon advises corrosive sublimate solution, 1-5000 to 1-3000; and iodoform in glycerin is warmly recommended by Berkeley Hill. Every one is agreed that nitrate of silver uniformly acts badly, and its use is contra-indicated.

After cystitis has set in the principal indications are to control the pain and tenesmus, but these matters have been considered in another section. (See "Cystitis.")

Under the head of **operative treatment** may be considered, first, the suggestion of Hoffmann, which was to inject 10-per-cent. emulsion of iodoform and glycerin into the substance of the prostate by means of a long needle thrust in through the perineum. This procedure has never gained favor, and is to-day practically abandoned.

A few years ago, when the *dictum* of Sir Henry Thompson, that "tuberculosis of the prostate was never primary, but always secondary to deposits elsewhere," was accepted as final, it was thought useless to attempt to extirpate the diseased prostate, and the rule was only to operate when pus had formed, in order to evacuate the contents of the abscess.

At the present time the opinion has changed, and the operation of laying bare the prostate by a semilunar incision curving around the rectum and removing all the diseased tissue with a curette commends itself as a rational and conservative procedure, and one which is likely to bring about a radical cure, when the disease is limited to the prostate alone.

When the prostate is secondarily affected, and deposits exist in other organs, the indication for operation is not so clear, but even in these cases an operation is likely to save the patient the misery and suffering from a prolonged course of suppuration of the prostate, with the slow formation of fistula.

DISEASES OF THE KIDNEYS.[1]

CHAPTER XVI.

MOVABLE KIDNEY.

An unnatural movability of the kidney occurs in two forms:—

(a) **Movable kidney** is more frequent in its occurrence. In this variety the kidney moves about freely behind the peritoneum, as it lies in a sort of pouch or cavity formed within its own fatty capsule.

(b) **True floating kidney** lies closely surrounded by its fatty capsule, and is supplied with a mesonephron, which is attached by one end to the spinal column, but which is so long that it allows the kidney to float about freely in the peritoneal cavity. The extent of the excursions of the kidney depends only upon the length of its mesonephron.

ETIOLOGY.

Movable kidney occurs more frequently in females than in males, Lindner finding that 1 out of every 5 or 6 women examined was so affected, and the right kidney is more frequently movable than the left.

True floating kidney is either caused by a congenital mesonephron or it may exceptionally be the last stage of a movable kidney.

Various reasons are suggested for the preponderance of movable kidney in the female, the chief of which are laxity of the abdominal walls as a result of child-bearing. On closer scrutiny, the facts do not uphold this theory, for a movable kidney is found as often among virgins and nulliparæ as among women who have borne children.

It is probable, however, that the cause of movable kidney in both sexes is the absorption of the fat which surrounds the kidney and acts as a cushion and support to it, as a consequence of the emaciation occurring in wasting diseases.

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[1] Among other authorities the author is particularly indebted to the work of Dr. Casper, Lehrbuch der Urologie, Berlin, 1903, in the preparation of the section on Diseases of the Kidneys.

If the fat is absorbed, a slight blow or muscular strain, such as the exertion of vomiting, may be enough to loosen the kidney from its attachment and permit it to move about more or less freely.

SYMPTOMS.

The symptoms of movable kidney are, of course, obscure. Gastro-intestinal symptoms, such as flatulence and dyspepsia, are generally present, and have been accounted for by the supposition that the kidney in its abnormal situation exerts pressure upon the duodenum and narrows its lumen, thus causing partial retention and fermentation of its contents.

Edebohls considers these symptoms due to pressure and traction upon or stretching and irritation of fibres of the solar plexus, lying in the abdomen and belonging to the sympathetic nervous system, because it would seem that the theory of obliteration of the lumen of the duodenum is insufficient to account for the symptoms.

Edebohls calls attention to the other symptoms which are generally caused by floating kidney, as follows: Pain is felt in the epigastrium, which is not increased by pressure, and is located somewhere to the left of the median line at or near the free border of the left costal cartilages. General nervousness in greater or less degree exists, and is usually accompanied by cardiac palpitation and habitually rapid action of the heart.

These patients are also unable to sleep or to rest comfortably while lying upon the left side.

In true floating kidney with a long mesonephron, in addition to the presence of the above-mentioned disturbances, the patient is conscious of abdominal pains, of a dragging or pulling character, and the sensation is felt as if some foreign body were moving about in the abdominal cavity, particularly after a sudden muscular exertion, or upon rising up suddenly after lying down.

The pain may be only wearing in character or it may occur in paroxysms and be agonizing. Its onset is sudden, and it is apt to follow fatigue or active exertion. The pain in some cases is due to attacks of local peritonitis.

Nervous disturbances, hypochondria, melancholia, and hysteria usually occur, either as reflexes or from disturbances of nutrition. The secretion of urine by the misplaced kidney is, in general, not interfered with.

DIAGNOSIS.

The diagnosis is not difficult to make in thin subjects with relaxed abdominal walls. By palpating the flank between the fixed border of the ribs and the crest of the ilium the displaced kidney can be felt between the two hands.

In fat subjects the diagnosis presents greater difficulties. If the kidney has been displaced into the pelvis, it may be mistaken for an ovarian or fibroid tumor; but the kidney may be differentiated by replacing it with ease in its natural position in the flank, while the attachment of its mesonephron prevents its complete descent into the pelvis.

If the mesonephron is shorter and the kidney is found lying in the abdomen, it might be looked upon as a distended gall-bladder, enlargement of the spleen, or a tumor of the omentum.

PROGNOSIS.

A kidney which once becomes movable never again becomes firmly fastened in place, except by operative interference.

A misplaced kidney, however, is, in general, not fatal to life, and, if death occurs, it is usually the result of exhaustion from chronic dyspepsia, continued pain, and nervous depression, although death is sometimes due to malignant disease developing in the displaced organ.

TREATMENT.

The symptoms of movable kidney may be ameliorated by lying in bed, by the Weir Mitchell treatment, and by massage and electricity; but none of these methods offers much prospect of permanent relief. (Edebohls).

A simple bandage of elastic webbing without any pad over the kidney and which, encircling the whole abdomen, makes as much pressure as the patient can comfortably bear, helps to support all the abdominal viscera and with them the kidney. Such a method may be tried before proceeding to operation, but it is generally found to be ineffective in holding the kidney in place.

On account of the difficulty of retaining the kidney in position, nephrorrhaphy, or fixation of the kidney, is advised by Edebohls as the first resort in patients with movable kidneys which produce decided symptoms.

Nephrorrhaphy is an operation which is not attended with much danger to life and it is generally successful in fixing the kidney and relieving the symptoms. Delvoie reports 215 cases operated on by fixation, of which 135 were cured, 30 improved, 25 unimproved, 20 relapsed, and 5 died.

Nephrectomy, or total removal of the kidney, has no justification when the kidney has only a small range of motion, and the operation is accompanied by a very high mortality.

In cases of true floating kidney with a long mesonephron, it may be impossible to fix the kidney in place. Such a contingency would demand nephrectomy by the lumbar incision if possible, and if this is not practicable, by means of a laparotomy, although the mortality is much higher with the abdominal route than when the kidney is removed through the flank and without opening the peritoneal cavity.

PYELITIS.

In suppurative pyelitis, often called *surgical kidney,* the pelvis of one kidney may be attacked alone, or both kidneys may be affected.

The **pathological change,** if due to an ascending infection, begins in the pelvis of the kidney, which becomes distended with pus, and if the ureter is blocked, so that the pus cannot be discharged into the bladder, in course of time the interstitial secreting substance of the kidney is utterly destroyed, and the organ is converted into a mere shell surrounded by its capsule and filled with pus. This condition is called **pyonephrosis.**

In **pyelonephritis** the suppurative process involves not only the pelvis, but the secreting structures of the kidney as well.

A number of small abscesses form between the tubules, and as they increase in size the intervening portions of tissue break down, so that several of the abscesses become merged into one.

The secreting parts of the kidney involved in the process are destroyed and the secretory function of the kidney is, of course, impaired.

When the organisms are carried through the blood and hæmatogenous infection takes place, they are deposited in the parenchyma of the kidney, causing primarily a pyelonephritis, but when the infection ascends from the bladder, through the ureters, the pelvis of the kidney is first attacked and the parenchyma becomes involved later.

After destruction of the kidney-substance the fluid portion of the pus is often absorbed, and upon autopsy the kidney is found to be made up of several sacculi containing grayish, putty-like masses, which are often mixed with calcareous material.

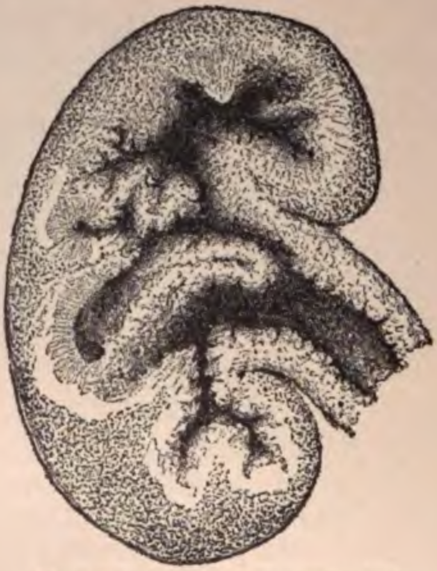

Fig. 126.—Tuberculous Pyelonephritis.

ETIOLOGY.

Suppuration of the kidney is always caused by **micro-organisms**, of which the most frequent forms are the staphylococcus aureus and the colon bacillus, and in tubercular pyelitis, the tubercle bacillus.

The modes of infection may be (*a*) *ascending*, caused by the passage of micro-organisms from the bladder upward through the ureters, and (*b*) *hæmatogenous*, in which case infective emboli ocurring in sepsis, tuberculosis, or the infectious fevers are conveyed to the kidney through the blood-current.

Predisposing Causes.—The most important and frequent cause of pyeltis, is inveterate cystitis from the retention of urine in the bladder behind a stricture or enlarged prostate.

The urine is dammed back upon the kidneys, causing a distension of the pelvis, and infection with micro-organisms, which are conveyed through the ureters from the bladder, readily takes place.

Renal calculi in themselves do not excite pyelitis, but the prolonged mechanical irritation to the kidney, which their presence causes, lowers its resisting-power and permits the entry of germs.

Infectious diseases—such as typhoid fever, pneumonia, scarlatina, small-pox, and general tuberculosis—lead to the formation of infectious emboli, which are carried through the general blood-circulation and are often deposited in the kidney.

SYMPTOMS AND COURSE.

Pyelitis may be acute or chronic, and as most cases are secondary to some other condition, the symptoms are often obscured by those of the primary disease.

The **acute form** begins with a chill and high fever, accompanied by dry tongue, thirst, and great prostration. The urine contains pus, bacteria and albumin, depending on the extent of the kidney involvement. Sometimes death follows quickly, but often the temperature subsides, either suddenly or gradually, or the fever may become remittent in type, until the temperature finally becomes normal and the acute attack merges into the chronic form.

In the acute form, the kidney region is seldom tender. Tenderness on palpation, as a persistent and prominent symptom, is usually a sign that abscess of the kidney is beginning or has already formed.

The transition from the acute to the chronic form is not infrequent, but **chronic pyelitis** generally begins insidiously, and both pyelitis and pyelonephritis may run their course without fever.

The ascending form of pyelitis is always accompanied by disease of the lower urinary tract and may result from acute gonorrhœa or cystitis, with obstruction to the urinary outflow, from stricture, hypertrophied prostate, paralysis of the bladder, vesical calculus or tumor.

Pyelitis may remain without change for many years and the pus formation may continue in the pelvis of the kidney for a long time, without its parenchyma being attacked. More frequently it happens that a nephritis becomes engrafted upon a pyelitis; but even a pyelonephritis often runs such a chronic course and the destruction of the kidney tissue is so gradual, that years may pass before the patient observes any disturbance.

This is, however, the exception, for usually, after some length of time, marked symptoms arise: the patient emaciates slowly, his tongue is coated, the nutrition is impaired, he is distressed with dyspepsia and vomiting, and he presents the aspect of a person suffering from some grave disorder.

This condition arises in the course of a unilateral pyelitis, as well as when both kidneys are affected, and is due not so much to a kidney insufficiently, as to a poisoning of the blood, or toxæmia. It comes much earlier in the progress of the case when frequent feverish attacks occur.

It is by no means infrequent that the pyelitis remains latent without causing any symptoms, until the operation of litholapaxy, internal urethrotomy, or the commencement of catheter-life causes it to become active.

In these cases the symptoms which arise are partly due to want of elimination, on account of the destruction of the secreting portion of the kidney, and partially from urinary fever, caused by the absorption of the micro-organisms and toxins into the circulation from a wound in the genito-urinary tract.

The symptoms consist in a diminution in quantity or complete suppression of the urine. The urine contains blood, often in abundance. The temperature rises, and is accompanied by feeble pulse and great prostration. Delirium and coma set in, and are followed by death.

Tenderness over the kidney region as a symptom of pyelitis is very unreliable; occasionally it is present and of some value, but its absence does not signify that the kidney is healthy. The patient often complains of an annoying feeling of weight in the kidney region, which is particularly noticeable on active movements.

A distinct tumor may be present or absent, for pyelitis may exist without any dilatation of the pelvis. On the other hand there may be an accumulation of pus, which will cause an appreciable swelling, or a pyelonephritis of long standing may cause a contraction of the kidney.

It frequently happens, that with a considerable amount of pus-formation, the ureter becomes occluded and the pus is drained back in the pelvis of the kidney, which becomes larger and more tender.

During the time of obstruction the urine becomes free from pus, and quite clear, and the retention is accompanied by fever and typical kidney-colic.

From the vague and unreliable character of the symptoms we are obliged to depend for diagnosis on the *changes in the urine.*

It has been believed that the urine of pyelitis presents certain characteristic alterations.

The quantity, reaction, presence of albumin, and form of the epithelium have been supposed to be pathognomonic, but at present we can only say that the one permanent and always present characteristic of pyelitic urine is that it contains pus.

While it is true that the urine of pyelitis and pyelonephritis is generally acid, it is also the case that many patients with cystitis have acid urine; and, again, if the urine in the pelvis of the kidney is alkaline, pyelitis will also show an alkaline urine.

The quantity of urine secreted is increased, and is from two to three times the normal amount.

Blood is frequently present, and is increased by activity on the part of the patient. It may be uniformly disseminated through the urine or appear as long clots formed in the ureters.

Microscopic examination of the sediment shows pus, albumin, small quantities of epithelial cells from the pelvis of the kidney, considerable mucin, and numberless micro-organisms.

If pyelitis is dependent upon a renal calculus, in addition to the pus-cells fragments of the calculus may be present, and crystals of uric acid, urates or triple phosphates are always found. The quantity of desquamated epithelium is greater, and some blood is present.

Persistent absence of casts is in favor of pyelitis, as in contracted kidney, casts may disappear for a time, but only temporarily.

Epithelium cells which are club-shaped, or composed of many layers attached together in sheets, were formerly supposed to originate in the pelvis of the kidney, but it is now known that these forms also occur in the deeper layers of the lower urinary passages, and consequently they cannot be regarded as distinguishing characteristics.

In uncomplicated pyelitis, albumin is but slight in quantity, and the small quantity present is accounted for by the pus in the urine. Even when large quantities of pus are formed, the albumin may not amount to more than .01 per cent.

In pyelonephritis the albumin is greater and out of proportion to the pus, and is relative in amount to the involvement of the kidney.

It is, however, impossible to differentiate a cystitis from a pyelitis by the amount of albumin.

There remains, then, the *single symptom of pus in the urine;* but as other diseases of the bladder, prostate, and urethra also show pus in the urine, in order to make the diagnosis of pyelitis it is necessary to determine if the pus comes from the kidney or not, and furthermore to decide if one kidney alone is diseased, or if both are affected.

The question as to whether cystitis or a pyelitis is present can generally be decided by observing the course of the case, as every case of cystitis, except those caused by malignant tumors, tuberculosis, or calculus, improves under local treatment of the bladder, and the improvement is demonstrated by the urine becoming clearer.

If no diminution of the quantity of the pus in the urine takes place, it may be accepted as a fact that the pus comes from the kidney or its pelvis.

A manœuvre which is sometimes of use, in differentiating between cystitis and pyelitis, consists in washing out the bladder thoroughly, and then waiting for fifteen minutes; the urine which has accumulated in the bladder during that time is then drawn off with a catheter.

If the kidneys are healthy, but cystitis is present, a ***small*** amount of pus will appear in the urine when it is drawn off, but if the bladder is healthy and pyelitis exists, the urine will contain a comparatively *large* quantity of pus.

The question, however, as to whether the pus comes from the bladder or kidney, as well as which side is attacked, can only be settled by **a cystoscopic examination with catheterization of the ureters.**

The ureter openings are viewed with the cystoscope, and a jet of turbid urine is often seen issuing from one or both mouths.

If the turbidity of the urine issuing from the ureter mouth is but slight, so that the observer is in doubt, the ureter catheter is introduced into both ureteral openings and the separate urines are drawn from each kidney.

If pyelitis is absent, the urine drawn from the kidney contains only epithelium and perhaps a few red cells (diapedesis through hyperæmia).

If pyelitis exists *pus cells* are present in the urine.

To decide if the parenchyma of the kidney itself is affected, or only its pelvis, the urine drawn with the catheter must be tested for urea, phloridizin and by cryoscopy (see Cryoscopy).

PROGNOSIS.

The prognosis of chronic pyelitis depends upon several factors.

A simple pyelitis can remain limited to the pelvis of the kidney without change for many years, and without involving the parenchyma of the organ, and the patient remains free from any particular discomfort.

In course of time, however, the parenchyma of the kidney is apt to be attacked and a condition of pyelonephritis is established, which leads to the gradual destruction of the kidney and offers a grave prognosis.

This is particularly true of cases of pyelitis in old men, caused by ascending infection from cystitis due to stricture, calculus, or enlarged prostate.

Such cases generally terminate fatally in the course of a few years, from pyelonephritis with toxic absorption.

The fatal end is often precipitated by any operative interference upon the lower urinary tract, and the presence or absence of pyelitis is usually the most important element in the prognosis in cases of vesical calculus, stricture, and enlarged prostate.

Unilateral disease of the kidney offers, of course, a better prognosis than when both kidneys are affected.

The treatment of acute pyelitis consists in the application of antiphlogistic remedies, local blood-letting, application of ice to the lumbar region, narcotics for pain, antipyretics for the temperature, urotropin for disinfecting the pelvis of the kidney, and the patient should be put upon a bland diet, with regulation of the bowels and copious draughts of spring water.

Under this treatment, in most cases, the active symptoms subside and the process becomes chronic.

In the presence of threatening symptoms, such as high fever and chills, after the exact diagnosis as to which side is affected has been made, an incision into the kidney (nephrotomy), with evacuation of the pus, sometimes has a brilliant curative effect upon both pyelitis and pyelonephritis.

The treatment of chronic pyelitis is conducted on the same lines as the acute form; urotropin, abundance of spring water, rest, baths, and diet being the principal measures, although the chances are small that the lesions will heal.

In *gonorrhœal pyelitis* or when caused by the colon bacillus, Casper and others have obtained excellent results from catheterizing the ureters and washing out the pelvis of the kidney with a nitrate-of-silver solution.

Casper reports 12 cases (9 gonococci and 3 bacillus coli) where all other means had failed, and which were entirely cured by this procedure. Irrigation of the pelvis of the kidney is contra-indicated in the presence of pyelonephritis, tuberculosis, or renal calculus.

Technique.—The ureter is catheterized in the usual way, and about one-half an ounce of nitrate-of-silver solution, beginning with 1 to 1000 in strength, is injected through the catheter into the pelvis of the kidney. The catheter is withdrawn, and the solution gradually flows out through the ureter.

At the present time very strong hopes of a cure cannot be held out, but this means of treatment may be tried before proceeding to operation.

OPERATIVE TREATMENT.

The operation indicated, depends upon the extent of the destructive process in the kidney and whether one or both kidneys are affected, and also if the process is tuberculous or not.

I. One Kidney Alone Diseased.—(*a*) In the case of an abscess of the kidney, from a punctured wound or a renal calculus, it is desirable to drain as early as possible, in order to prevent destruction of the kidney-structures.

In unilateral pyelitis which is not too far advanced, and not tuberculous in origin, good results are obtained by the operation of **nephrotomy.**

The kidney is exposed and the pelvis irrigated with 1-1000 nitrate-of-silver solution, and the wound kept open and drained. If the kidney is found riddled with small abscesses, it is now thought advisable to do **nephrectomy** and remove it at once.

It was formerly believed to be safer to allow a few days to elapse after cutting down upon the kidney, before removing it, but further experience shows that it is better for the patient, to take out the kidney at the first operation, if nephrectomy is indicated.

II. Both Kidneys Diseased.—In such conditions nephrectomy is out of the question, and in feeble old men, who are suffering from stricture or enlarged prostate, no operation can be undertaken which holds out much prospect of recovery.

If the patient with a double-sided pyelitis is in better general condition it has been suggested doing a *nephrotomy* on one side, and after draining the kidney for a time, doing a nephrotomy on the second kidney.

Evacuation of the pus through an incision may relieve the septic condition, and, if the kidneys are not too much disorganized, they may be able to carry on their eliminative function sufficiently to maintain life.

The questions as to the ultimate cure and the amount of danger following this procedure are still under discussion.

HYDRONEPHROSIS.

When, from some mechanical obstacle in the ureter, the urine is prevented from flowing out from the pelvis of the kidney, retention of the non-purulent urine occurs, and the pelvis and calyces of the kidney become enormously dilated. Atrophy of its secreting substance takes place, with the formation of distinct cysts, which may attain to a very great size.

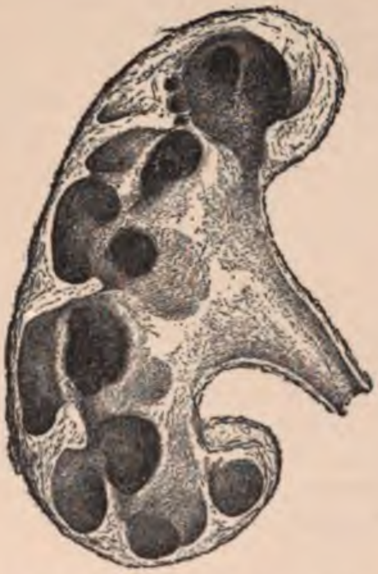

Fig. 127.—Hydronephrotic Kidney without much enlargement.

ETIOLOGY.

Congenital Causes.—The ureter may be entirely absent, or obliterated in some part, or the obstruction may develop after birth, on account of a twisting of the ureter or the formation of a valve-like fold, causing partial or complete closure of its lumen.

If an abnormal insertion of the ureter exists either at its origin from the pelvis of the kidney or at its entrance into the bladder, the angle of the insertion of the ureter may be so acute that it is compressed and its lumen closed when the patient is in the standing position.

Acquired Causes operate either by compressing the ureter or obstructing the outflow of urine and causing it to be dammed back upon the kidneys. Tumors of the ovary and ureters, prostatic hypertrophy, and atony of the bladder will produce this effect at times.

A very frequent cause of hydronephrosis is a renal calculus, acting as a ball-valve, as it lies in the pelvis of the kidney at the mouth of the ureter, or if it enters the ureter and becomes fixed at any point in its course.

From any of these causes the obstruction may be *complete,* so that no urine can pass through the ureter; or it may be *incomplete,* and a portion of the urine passes through into the bladder.

Intermittent hydronephrosis occurs chiefly as a result of a movable kidney, as changes in the position of the kidney cause bends and twists in the ureter, and in consequence stagnation of the urine in the pelvis of the kidney, and ultimately dilatation with cystic formation.

The sac becomes completely filled, and then, if the obstruction is temporarily removed, it is emptied, and a large discharge of urine occurs into the bladder, and the hydronephrotic tumor disappears.

The obstruction in the ureter returns and the sac gradually refills, and after a varying time is again emptied.

The process of accumulation and discharge is repeated indefinitely unless the ureter becomes completely and permanently blocked, which usually occurs in the course of time.

SYMPTOMS.

The symptoms of hydronephrosis are vague and indefinite, and consist in the formation of a fluctuating tumor in the flank, which may be large enough to fill the entire abdominal cavity, together with frequent urination, and a diminution in the quantity of urine passed. The symptoms caused by *intermittent hydronephrosis* are generally occasioned by a movable kidney, in which condition the ureter is obstructed by being bent at an angle.

The attacks are accompanied by violent pain and diminution in the quantity of urine and may easily be mistaken for an attack of renal calculus. When the kidney falls back into its normal place the ureter is straightened out, the pain ceases suddenly, and large quantities of urine are discharged.

PROGNOSIS.

Hydronephrosis may remain stationary for years, but the pressure of the accumulated fluid leads, in time, to an atrophy of more or less of the parenchyma of the kidney-substance, although the secreting structures are never entirely destroyed.

The affection is often complicated by infection with pyogenic organisms, and the case becomes converted into one of pyonephrosis, with its attendant dangers.

Large sacs have been known to rupture into the abdominal cavity and cause peritonitis, and in a few cases of intermittent hydronephrosis, spontaneous cure has occured.

DIAGNOSIS.

The diagnosis presents many difficulties, although a history of the sudden disappearance of a tumor coincident with the discharge of large quantities of urine is eminently suggestive of intermittent hydronephrosis.

An ovarian tumor is very liable to be mistaken for hydronephrosis. The distinguishing points are the situation of the kidney tumor in the flank, with the colon or small intestine in front of it.

Exploratory puncture of the tumor may throw some light upon the case, by furnishing a fluid containing urea or uric acid, but those ingredients of urine often disappear by absorption, and the liquid resembles that contained in any simple cyst. Catheterization of the ureters may settle the question of diagnosis, by demonstrating if urine issues from one or both ureters and if it is clear or purulent.

TREATMENT.

It is seldom possible to remove the obstruction in the ureter and re-establish the flow of urine through it, except when due to movable kidney or pressure upon the ureter from an abdominal growth, and the various attempts to do away with the obstruction by massage and ureteral catheterization, etc., have been rarely crowned with success.

In **double hydronephrosis** incision of both sacular kidneys by lumbar nephrotomy, with an interval between the two operations, and the establishment of a permanent fistula, although causing great inconvenience to the patient, affords the only hope of arresting the destruction of the secreting portions of the kidney and saving the life of the patient.

In **unilateral hydronephrosis** incision and drainage through the loin (nephrotomy) is the operation of choice, and later on, if the annoyance of the fistula becomes unbearable and the other kidney is found to be healthy, nephrectomy may be done upon the diseased kidney and the fistula allowed to close.

Before nephrectomy is undertaken it may be desirable to endeavor to remove the obstruction in the ureter by catheterization, or the advisability of transplantation of the ureters may be considered.

The operation of aspiration, or **lumbar puncture,** although formerly practiced, is seldom employed to-day, except in the cases where an operation is strongly indicated, but for some reason nephrotomy cannot be performed at the time.

In certain cases of intermittent hydronephrosis, a permanent cure is said to have followed the operation of lumbar puncture.

When hydronephrosis depends upon a movable or floating kidney, nephrorrhaphy is indicated, and when the kidney is fixed in place, the accumulation of urine and overdistension of the pelvis of the kidney may cease.

PYONEPHROSIS.

Pyonephrosis is always secondary to some other condition, and it may develop in two ways:—(*a*) As a result of infection with micro-organisms of the watery contents of the kidney in *hydronephrosis,* Or, (*b*) In consequence of the occlusion of the ureter in a case of *pyelonephritis.* In either instance, the pelvis of the kidney becomes rapidly distended, and the kidney itself is soon destroyed by the formation of multiple abscesses in its parenchyma. The entire kidney becomes converted into a large sac surrounded by its capsule and filled with urine and pus.

In course of time the tumor becomes firmly attached to the abdominal wall by adhesions, and suppuration occurs outside the kidney, forming para-nephritic abscess.

The ureters become thickened in their walls, and often converted into an impervious string of tissue; or on the other hand, the ureters may be dilated.

SYMPTOMS.

On account of the different ways in which pyonephrosis begins, the clinical picture is a varying one.

One symptom which is always present as long as the ureter remains patulous is *pus in the urine.* This, as a rule, is constant, and not remittent, unless the ureter becomes occluded, when constitutional symptoms occur. Under such circumstances colicky pain in the lumbar region is felt, the pus disappears from the urine, and the quantity of urine is diminished; septic fever, with chills and well-marked remissions, also occurs. If the ureter becomes patulous again, pus reappears in the urine and the temperature falls to normal.

Disappearance of pus from the urine, however, does not invariably imply that the ureter is occluded. For it sometimes happens that the abscess-cavity in the kidney empties itself entirely of pus, and the urine remains clear for several days, until the pus reaccumulates in the kidney and again begins to flow out through the ureter.

In cases of pyonephrosis, a *tumor* is present and is felt as a rounded, tender, obscurely-fluctuating mass, located under the free border of the ribs. The tumor can usually be felt, unless it is high up under the ribs and the pus has been temporarily drained out through the ureter.

Pain is a somewhat inconstant symptom; often it is not present, or may only be elicited by deep pressure.

The general health of the individual always suffers in consequence of the drain of the suppuration and the attacks of septic fever, and the patient becomes emaciated and anæmic.

DIAGNOSIS.

The first point to determine is, if one kidney alone is affected, or if both are diseased.

Sometimes a cystoscopic examination of the bladder shows a stream of purulent urine coming from one or both ureters.

If this is not adequate to establish the diagnosis, the ureter on the suspected side may be catheterized and the urine drawn from the bladder with a catheter for examination for comparison, or both ureters may be catheterized and the right and left urines examined.

In this way we can ascertain if the second kidney is healthy and how it is working. To decide the question as to whether it is at all diseased or if badly crippled, a chemical and microscopical examination of the separate urines is necessary.

PROGNOSIS.

The prognosis depends on how rapidly the suppuration advances, and, furthermore, if one kidney is affected, or both.

Unilateral pyonephrosis offers a better prognosis, and can exist for years without a bad effect upon the general health. In course of time, however, the long-continued absorption of toxins into the blood sets up a toxic nephritis upon the other side.

In exceptional instances spontaneous healing may occur, for the entire kidney may suppurate and be destroyed, becoming converted into a mass of connective tissue. This outcome is so extremely rare that it cannot be hoped for.

More frequently, however, when the suppuration is allowed to advance without operative interference, the surrounding connective tissue is attacked and a diffuse perinephritis and paranephritis is set up.

TREATMENT.

The treatment depends upon the character of the process and whether one or both kidneys are affected.

Internal treatment is of no use, since it is impossible to make the suppurating kidney-sac aseptic by drugs given by the mouth.

It is necessary to attack the foci of suppuration locally, either by irrigation of the pelvis of the kidney through a ureteral catheter, or by means of incision or extirpation of the kidney.

Irrigation of the pelvis of the kidney is at present too new a method of treatment for us to decide its definite value.

Casper states that it is very limited in its application, and is only useful in cases of infected hydronephrosis.

He reports two cases in which the pelvis of the kidney was converted into a great pus-cavity, which were healed by irrigation of 1-to-1000 nitrate-of-silver solution.

In such cases as these it is proper to make the attempt to heal the pus-cavities by irrigation through a ureteral catheter.

In a case of pyonephrosis, however, in which the kidney-substance is riddled with abscesses, which may not communicate with the pelvis of the kidney, the irrigation method is useless.

After the pelvis of the kidney has been successfully drained and washed out through the ureteral catheter a few times, and the patient's condition does not show a decided improvement, no further time should be lost, but operative measures should be proceeded to at once.

Nephrotomy is particularly applicable to the cases of infected hydronephrosis in which a good deal of healthy kidney-tissue is remaining; while by the typical multiple abscesses in the parenchyma of the kidney, *nephrectomy* is preferred on account of the danger of of a fistula remaining behind. Before doing nephrectomy, however, the surgeon must know that the second kidney is competent to excrete the urinary secretion.

If the second kidney is badly diseased with its function impaired, nephrotomy is contra-indicated, as it is a severe operation for an individual in broken-down health. Nephrotomy also fails to afford much benefit, as the patient is always annoyed with a troublesome fistula, which is continually leaking. For these reasons many surgeons are of the opinion that cases of double pyonephrosis are inoperable.

RENAL CALCULUS.

The formation of stone in the kidneys is of frequent occurrence, and often precedes vesical calculus. Stones composed of uric-acid crystals are most common, and the next in point of frequency are oxalic stones. Phosphatic calculi are rare, and are caused by the alkaline decomposition of urine as a result of pyogenic infection.

The stones are found in the pelvis of the kidney, and may be single or may be in hundreds.

ETIOLOGY.

The causation of kidney stone is generally the gouty diathesis (see "Vesical Calculus"). A few crystals are agglomerated in one of the renal tubules upon some substance, such as a blood-clot, coagulum of pus, or roughness of the wall, which serves as a nucleus. The agglomeration is washed out into the pelvis of the kidney, where it becomes the nucleus of a calculus.

The stone, if single, may be adherent to the walls of the pelvis of the kidney, or it may be movable and act as a ball-valve, closing the mouth of the ureter. The urine is dammed back, in consequence causing *hydronephrosis.*

Infection with micro-organisms usually occurs, and suppurative nephritis follows.

SYMPTOMS.

A stone may be present in the kidney for years without causing much discomfort, as the symptoms are due, not to the mere presence of a foreign body, but to obstruction. They are as follows:—

(*a*) Attacks of renal colic.
(*b*) Pain.
(*c*) Hæmaturia.
(*d*) Pyuria.
(*e*) Disturbances of the urinary function.
(*f*) Gastro-intestinal disturbances.
(*g*) Passage of fragments of calculi.

Attacks of renal colic are strongly indicative of kidney stone, although typical paroxysms may be induced by other causes, and not infrequently renal stone has been diagnosed and operated for and its absence demonstrated on cutting open the kidney.

Renal colic is caused by the stone being forced out of the pelvis of the kidney and entering the ureter. An attack comes on abruptly, and is characterized by agonizing pain, which is felt in the loin, and radiates down into the testicle and along the inner side of the thigh.

The pain may also radiate through the abdomen and chest, and be very intense in the back. In severe attacks nausea and vomiting occur, the pulse is feeble, the skin is covered with a cold sweat, and the patient is in a state of collapse.

In lighter cases urination is frequent, and the urine discolored with blood, or the patient may be unable to empty his bladder.

In rare cases the secretion of urine may be entirely suppressed either from (*a*) reflex disturbance of the secreting kidney; (*b*) extensive disease of the other kidney, whose ureter is not blocked; (*c*) where only one kidney exists in the body.

Fig. 128.—Radiograph of Renal Calculus. Nephrolithotomy. (Author's case.)

In these cases uræmic symptoms develop after a week, and death takes place within a fortnight after the obstruction.

The pain and disturbance of ureteral colic may last for a few minutes or for a number of hours, and usually cease abruptly as the stone either drops back into the pelvis of the kidney or makes its escape from the lower end of the ureter and enters the bladder.

The stone occasionally becomes permanently fixed in the ureter, in which case, after some time, the walls give way slightly around it, permitting a portion of the urine to pass by; but the urine is dammed back upon the kidney, and *hydronephrosis* is developed.

Pain is felt over the affected kidney, which is increased by motion, jarring, and pressure over the side.

The sensation is that of a feeling of weight, rather than of acute pain, but the patient is liable to have paroxysms of acute pain, which often occur at night, when he is at rest in bed.

The pain radiates along the ureter and into the testicle, and often causes contraction of the cremaster muscle, with drawing up of the testicle on the affected side. The pain may be referred to the healthy kidney or to the bladder, thigh, or calf of the leg.

Hæmaturia occurs most frequently when the stone is passing through the ureter, but may appear when the stone is in the pelvis of the kidney.

The bleeding may come on in a slight amount, giving the urine a smoky color, or the urine may be free for days until, after some sudden exertion or a prolonged ride, a considerable amount of bleeding takes place.

Pyuria occurs only after suppurative disease of the kidney has occurred, but this is usually established in time.

Disturbances of Urinary Function.—The irritative effect of stone in the kidney causes it to secrete an excessive quantity of urine by day when the patient is moving about, but at night, when he is quiet in bed, the secretion of urine is normal in quantity.

As a result of blocking the ureter with a stone, the urine may be diminished in quantity or entirely suppressed for a time. If it persists after the attack is past, it is clear either that the ureter of the functionating kidney is blocked with a stone and that the other kidney is so much diseased that it is not capable of secreting, or else that there is only one kidney present.

Occasionally the obstruction develops insidiously, without attracting attention until symptoms of uræmia set in.

Gastro-intestinal disturbances may be reflex in origin or may result from imperfect elimination by the diseased kidneys. Dyspepsia, vomiting, and epigastric tenderness may easily cause the condition of the kidneys to be overlooked.

Passage of fragments of calculi is very often absent, or the fragments are overlooked by the patient, but when present is of great value in indicating the presence of kidney stone, even though colic was not caused by the passage of the fragments through the ureters.

DIAGNOSIS.

A positive diagnosis of renal calculus is difficult to make, and many cases are on record in which the kidney was incised for the purpose of removing a stone when none was present.

The most characteristic symptoms of kidney stone are passage of gravel or fragments of stone, attacks of typical renal colic, hæmaturia, and in time, pyelitis.

Hæmaturia and pain are often caused by tubercular or malignant disease of the kidney, and oxaluria and strongly-acid urine occasion a dull ache over the kidneys or even paroxysms of pain, which are sometimes accompanied by hæmaturia.

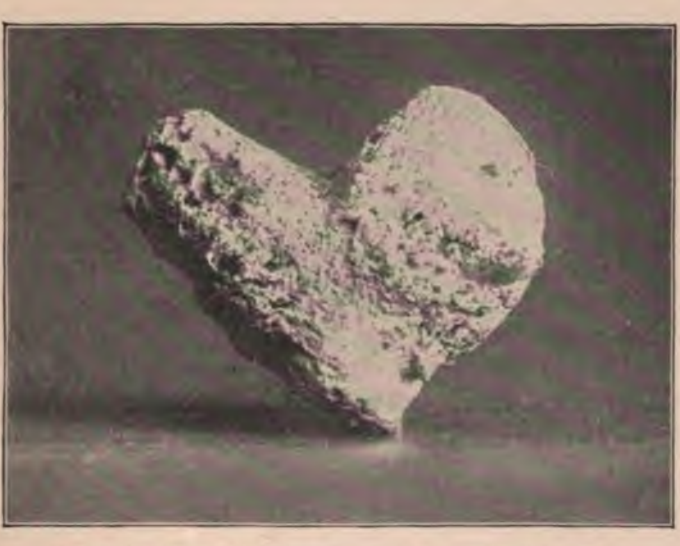

Fig. 129.—Renal Calculus removed by nephrolithotomy. (Author's case.)

Spinal caries of the lower dorsal vertebræ and locomotor ataxia may simulate the pain of kidney stone.

During an attack of renal colic it may be impossible to distinguish between the passage of a gall-stone or of a stone through the ureter.

Before attempting any operation it is of course essential to determine if both kidneys are affected or if the disease is confined to one side only. The location of the pain and tenderness on palpation throw some light as to which side the disease is located upon; but the question may be settled positively by catheterization of the ureters.

The x-ray has been of great use since its introduction in diagnosing cases of kidney stone, and is now regarded as one of the indispensable diagnostic aids.

Within the last year or so improvements have been made in the apparatus and technique of radiography, by which it is possible to make skiagraphs of moderate-sized objects upon which a diagnosis can be made regardless of signs and symptoms.

In order to do this the ray of selective absorption must be obtained.[1]

It is possible to show some renal calculi in skiagraphs made without this ray, but such plates are worthless in making negative diagnoses.

Short exposures are necessary, to avoid burning the patient. For all patients weighing 150 pounds or less, Cole exposes them 5, 15, or 20 seconds.

With the recent improved instruments finer gradations of shadows and greater contrasts between the different soft tissues are shown. The shadows were formerly more liable to be misinterpreted as calculi, by an inexperienced observer.

As a final resort in the cases where stone is suspected and the patient's health is failing, it is justifiable to make an exploratory incision into the kidney by lumbar nephrotomy.

PROGNOSIS.

A stone may remain in the pelvis of the kidney for years without causing any serious disability, and only at times induce transient pain or hæmaturia; but the patient is continually exposed to the danger of obstruction of the ureter and suppuration of the kidneys from pyogenic infection.

If a fragment of stone passes into the ureter, it usually escapes into the bladder, but if it become impacted in the ureter, disorganization of the kidney ultimately takes place, and the same is true if suppuration of the kidney occurs.

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[1] L. G. Cole, Medical Record, January 7, 1905.

TREATMENT.

Attacks of renal colic are sometimes cut short, by a prolonged hot bath and a full dose of morphia hypodermically.

In giving opium it is necessary to exercise caution and not give too large a quantity, for as soon as the stone is released and slips out of the ureter the pain ceases, and the patient may be overcome by the effect of the drug.

In cases which do not respond to morphia it may be necessary to secure relaxation by means of anæsthesia with chloroform or ether.

In the intervals of the attacks the general diathetic condition of the patient upon which the formation of stone depends should receive proper attention (see "Treatment of Stone in the Bladder").

But little success has been attained by efforts at dissolving stones. Piperazin in 5-grain doses taken in a pint of water three times a day is thought to have some effect in dissolving the albuminous framework of a uric-acid calculus, and phosphatic stones may perhaps be softened and broken down by Urotropin.

It is said that a small stone may sometimes be assisted in passing through the ureter by administering glycerine ℥iss by the mouth, three times a day.

The most important point in the treatment, in addition to regulation of the diet and general hygiene, is to keep the urine abundant and of low specific gravity, by drinking freely of pure spring- or distilled water.

Although a stone may remain for years in the pelvis of the kidney without danger to life, certain conditions—such as a deterioration of the general health, blocking of the ureter, or pyogenic infection of the kidney—call at once for the operation of *nephrolithotomy*.

This is indicated when the pain is persistent and severe, calling for the constant use of anodynes and accompanied by frequent attacks of renal colic and gradual emaciation and loss of strength.

Through a lumbar incision the kidney can be exposed and cut into, on its outer convex side, sufficiently to admit the finger into its pelvis, which can be thoroughly searched and the stone found and removed.

If the kidney has been the seat of prolonged suppuration and has undergone complete disorganization, nephrectomy (entire removal of the kidney) may be indicated.

TUBERCULOSIS OF THE KIDNEY.

Renal tuberculosis was formerly supposed to originate invariably in the bladder and prostate, and to ascend through the ureters to the kidney: but it is now known that the tubercule bacilli are carried through the blood-circulation and deposited in the kidney, thus causing a *primary infection* of the organ.

The bladder is frequently affected secondarily, by the bacilli passing with the urine from the kidney, or it may remain entirely unaffected.

An ascending infection of the kidney from a tuberculous bladder is an occurrence of great rarity.

PATHOLOGICAL ANATOMY.

The process begins with the deposit of numerous isolated tuberculous nodules in the kidney. These rapidly coalesce, the tissue breaks down, and cavities filled with pus or cheesy debris are formed. Alongside of these cavities in the kidney parenchyma, numerous recent or cheesy tuberculous deposits occur, which are seen as small nodules on the surface of the organ. After a time the neighboring structures become affected, the proper and fatty capsule of the kidney is thickened by the formation of cicatricial tissue, or perinephritic abscesses may form. The ureters also become affected in a case of long-standing tuberculosis of the kidney. The process in the ureters may be a simple inflammation, in which case, the walls become thickened and the canal may be converted into a solid string and agglutinated to the surrounding parts.

If the process is tuberculous, ulcerations and nodules form upon the ureteral mucous membrane.

The bladder nearly always becomes infected with the tubercle bacilli, as they descend from the kidney in the urine, although in exceptional cases it may escape entirely, or becomes the seat of a simple non-tuberculous inflammation.

Tuberculosis of the kidney begins on one side, and remains unilateral until after an uncertain length of time has elapsed, when the other kidney becomes infected through the blood.

The fact that only one kidney is attacked at first, and the other one not until some time later, has a most important relation to the treatment of such cases.

The second kidney, instead of being infected with tuberculosis, may also become the seat of amyloid degeneration or chronic nephritis.

SYMPTOMS AND DIAGNOSIS.

Renal tuberculosis is most apt to occur in young persons of from 20 to 30 years of age, and a family history of tuberculosis can often be elicited.

The disease begins very insidiously. A mild febrile state, with loss of appetite and general malaise, is noticed. The most characteristic symptom is frequent urination, water being passed every hour or two by night, as well as by day.

When the tuberculous nodules have not broken into the pelvis of the kidney, or if the ureter is obliterated, the urine can remain perfectly clear and give rise to mistakes; but usually the urine has a mild opacity like milk-tinted water, from its admixture with pus.

Occasionally, severe pain in the loins and down the side, accompanied by nausea and vomiting, is noted, so that renal calculus is suspected.

If the bladder is involved, the patient suffers from the typical bladder symptoms of dysuria and tenesmus, but these symptoms often arise as pure reflexes from the pelvis of the kidney.

As the diagnosis in these cases is always very difficult to make, it is necessary to call in all the means of assistance at our command.

A careful history should be taken, and an examination made for tuberculous deposits in the lymphatic glands, bones and lungs, and the epididymis, prostate, and seminal vesicles should be carefully searched for nodules.

The fact that an uncured gonorrhœa may also be the basis of a tuberculosis should always be remembered.

On palpation over the renal region a painful enlargement of the kidney may be detected, but not invariably.

Suspicion of kidney tuberculosis should always be aroused by the presence of pus in the urine for which no cause can be found; and when the pyuria does not clear up under appropriate treatment for cystitis, but persists, it usually signifies that the disease is not in the bladder, but in the kidney.

A microscopic examination of a drop of sediment from the urine should be made, and when every field is found to be made up of few or many leucocytes, and particularly if micro-organisms are conspicuously absent, the suspicion of tuberculosis is increased.

The specimen should next be stained and examined for the tubercle bacillus, and care should be taken to differentiate it from the smegma bacillus, which it closely resembles.

The tubercle bacillus is not easily found, but in from 70 to 80 per cent. of all cases careful and repeated examination will disclose it.

When, after four or five examinations, the tubercle bacilli have not been found, a positive diagnosis can usually be made by making an injection of the 24-hour centrifugated urinary sediment into the peritoneal cavity of a guinea-pig. Three weeks later the pig is killed and an autopsy made, and in positive cases an acute miliary tuberculosis of the guinea-pig is found.

Cystoscopy and Ureteral Catheterization affords great help in making a diagnosis. When the urine is loaded with pus, which does not clear up under treatment, and the cystoscope shows the bladder to be fairly normal, the conclusion is naturally drawn that the pus comes from the kidney, and on viewing the ureteral opening a stream of turbid urine may often be seen issuing from one or both ureteral orifices.

Characteristic changes are often observed in the bladder, about the mouths of the ureters. The ureter papillæ are congested and studded with ulcerations or hæmorrhages.

Willy Meyer describes the appearance of an œdematous pouting or prolapse of the mucous membrane around the ureter, with more or less erosion and hyperæmic lesion on the part of its periphery, as pathognomonic of kidney tuberculosis.

It is absolutely essential, before advising any line of treatment, to know the condition of the other kidney, and every possible means should be used to determine its functional capacity before operation is considered.

In order to find the relative secreting capacity of each kidney, the ureters should be first catheterized and the separate urines examined.

There are at present *three methods in use for testing the urine secreted by each kidney*, which are briefly described as follows:—

I. Comparison of Urea Secreted by each Kidney.—It has been proven by experiment that healthy kidneys secrete exactly the same amount of urea during and at the same time, and if one kidney is diseased the excretion of that organ is diminished.

A full quantity of urea would thus show a normal kidney, while a marked diminution in the urea from the other kidney would show disease of that organ.

The urea test commends itself because it is accurate and can be easily carried out with a simple testing apparatus. Rovsing prefers it to the other methods.

II. The Phloridzin Test is based on the fact that phloridzin causes an activity of the kidney-cells which enables them to withdraw sugar from the blood, and on examining the urine we find glucose.

When the secreting power of the kidney is at its highest a large amount of sugar will be produced, and when the secreting function is impaired less sugar will be eliminated.

Phloridzin Merck, in gr. $^1/_{10}$ doses, is injected hypodermically, and the elimination of sugar begins from fifteen to thirty minutes later. The ureters are then catheterized and the urine examined.

Healthy kidneys will generally produce about 1 per cent. of sugar and over; while in defective kidneys the quantity of sugar eliminated amounts to a small fraction of 1 per cent., and in greatest disturbances of the renal function no elimination of sugar can be accomplished.

III. Cryoscopy was first suggested as a means of determining the functional capacity of the kidney by Koranyi, in 1893.

As first used, it consisted in freezing a quantity of the blood and a quantity of the urine from the same patient and comparing their respective freezing points.

The test is based upon the physical law, that the freezing point of a fluid is lowered in proportion to the concentration of the solution, *i.e.*, when the solution contains more salts the freezing point is lowered.

The normal freezing point of the blood is constantly from — 0.56 to — 0.58 centigrade. Any deviation from this point, either higher or lower, shows that the kidneys are not secreting enough and the salts are retained in the blood.

Various conditions besides disease of the kidneys alter the freezing point of the blood.

I. Absorption of toxins from a malignant growth often elevates the freezing point.

II. Hydræmia causes a lowering of the freezing point.

We now know that malignant tumors and uræmia interfere with the test of cryoscopy of the blood and falsify the readings.

Casper and Israel no longer depend on the freezing point of the blood, but have abandoned it, while Koranyi and Künmell still make use of it.

Casper and Israel also find that although a kidney may be diseased, it may nevertheless functionate sufficiently to support life, after a nephrectomy of the other side.

In making the test of cryoscopy the general practice at the present time is to collect the urines, by ureteral catheterization, from the right and left kidneys at the same time, and compare their freezing points.

As the specific gravity of urine continually varies, there is no constant freezing point for it, and the test is therefore based upon the following facts:—

(*a*) Many molecules in the urine show a good excretion.

(*b*) A low freezing point shows that the kidneys are excreting well.

(*c*) If both kidneys are diseased, there is diminished secretion and the freezing point of both urines is high.

(*d*) If one kidney is diseased, the freezing point is high on the diseased side and low on the sound side.

In order to carry out the methods above described, it is necessary to have the separate urines drawn with a ureteral catheter from the right and left kidneys at the same time, as these tests are all based on a comparison between the separated urines.

The following scheme of examination was used in Casper's clinic is cases of suspected pyelitis.

(*a*) Injection of phloridzin hypodermically, strength 1 to 100; 1 cubic centimetre of solution injected.

1. Bladder irrigated and filled with 300 cubic centimetres of oxycyanat of mercury, 1 to 5000.
2. Double-sided ureteral catheterization.
3. First few drops of urine thrown away.
4. Collect three cubic centimetres of urine for microscopic examination.

(*b*) Examination for sugar.

(*c*) As soon as sugar appears, collect six cubic centimetres of urine from each side. One-half cubic centimetre of urine for determination of sugar with Lohnsteïn's saccharometer. Remainder for cryoscopy and determination of presence of albumin and quantity of urea.

Besides requiring a well-equipped laboratory, with a considerable knowledge of the laboratory technique, obtaining the separate urines by ureteral catheterization demands a high order of operative skill in the use of the catheterizing cystoscope, which can only be obtained after months of constant practice.

For these reasons the employment of these methods will be necessarily limited to specialists; and before any kidney operation, the three tests made by comparing the excretion of urea, sugar after phloridzin, and cryoscopy should be made.

It is in this way alone that we can avoid the fatal error of removing a kidney which, although damaged, may be the only one left to the patient.

PROGNOSIS.

The prognosis in renal tuberculosis depends on whether both kidneys are diseased, or if one alone is affected.

If one kidney is diseased, it should be removed at once,—before involvement of the other kidney or the bladder. In that case, the prognosis is good, and the patient's condition begins to improve immediately after the extirpation of the diseased organ.

In double-sided disease the outlook is very grave.

The course of a case which is not operated upon is generally slow. It lasts a considerable time, often several years, before the parenchyma is so much destroyed that the secreting function is badly impaired. Usually metastatic deposits with general tuberculosis occur, and when this takes place the fatal issue is rapidly reached.

In the course of kidney tuberculosis the peri-nephritic tissue becomes involved, suppuration takes place, and peri-renal abscess forms.

The symptoms are acute, and consist in painful tumor in the kidney-region, with chills and fever and great prostration.

TREATMENT.

When both kidneys are affected with tuberculosis, or one is tubercular and the other badly disorganized from chronic Bright's or amyloid degeneration, the treatment can only be directed to the palliation of symptoms, and consists in forced nutrition, irrigation of the bladder, and internally, urotropin, grs. viiss t.i.d.; with narcotics to relieve pain.

In the cases where pyonephrosis forms, and as a result of the accumulation of pus in the kidney, the patient suffers from severe sepsis from absorption, and it is evident that death will occur unless the kidney is opened and drained, a nephrotomy should be done and the pus evacuated.

If the other kidney is diseased, complete extirpation, or nephrectomy, is manifestly impossible, and the operation of nephrotomy is undertaken merely as a palliative measure.

The wound should be left open, and allowed to heal by granulation; and usually a permanent fistula remains. The evacuation of the pus, however, relieves the patient of his urgent symptoms and prolongs his life.

When, however, one kidney alone is affected with tuberculosis, and the patient comes under observation early, before the second kidney is involved, it is advisable to remove at once, and completely, the diseased organ.

Even a moderate bladder or lung tuberculosis, if not too far advanced, is not a contraindication for operation; the bladder heals, or at least improves, when the source from which the tuberculous material is poured into it is removed.

It has sometimes been the practice in past years to wait for a spontaneous healing of renal tuberculosis to take place; and while this sometimes happens in rare instances, it is so unusual that it cannot be depended upon, and in most cases which are left alone the process extends to the other kidney and to other organs.

Perinephritic abscess forming as a result of tuberculous kidney, calls for surgical treatment at once. The pus must be evacuated by a free incision, and the treatment of the kidney itself depends upon the condition of the other one.

MALIGNANT TUMORS OF THE KIDNEY.

In considering cancerous growths of the kidney it will be necessary to discuss *primary deposits;* for while secondary metastases may occur in the kidney from foci elsewhere, the diagnosis is usually easy, and from the nature of the conditions these cases are inoperable.

In childhood the kidney is not infrequently the seat of sarcoma, while in adult life carcinoma is the growth usually found.

SYMPTOMS AND DIAGNOSIS.

An early diagnosis is of the utmost importance to the life of the patient, as, if the kidney is removed soon enough, metastatic deposits will not take place in other organs.

On this account every instance of bleeding from the kidney should be regarded with attention, the ureters catheterized, and the functional capacity of each kidney tested.

The relative tests of the urine from each kidney by cryoscopy, phloridzin, etc., show that when the secreting cells have been destroyed and replaced by a new growth, the secreting capacity of that kidney is less than the one on the other side.

The *symptoms* of malignant disease of the kidney may be tabulated as follows:—

(*a*) Pain in the kidney region, more or less inconstant.

(*b*) Presence of a tumor.

(*c*) Hæmaturia.

(*d*) Cachexia of cancer.

(*e*) Sudden appearance of varicocele.

(*f*) Rheumatic pains in different bones, and enlargement of lymphatic glands.

Considering the above symptoms in detail of **the changes in the urine** which may occur, the appearance of blood in the urine is the only reliable symptom; while pus-cells are often found, they have no particular significance and are due to secondary infection.

The appearance of epithelial cells under the microscope is of little diagnostic importance, for the various cells, both normal and pathological, from the kidney, become altered by prolonged contact with urine and are no longer typical.

Albumin and casts may be found after secondary nephritis has occurred.

The hæmaturia may be very free, or may be so scanty that it is only perceptible with the microscope.

It is, of course, of the utmost importance to determine from which kidney the blood issues. This can be done by cystoscopy; the blood may be seen issuing from the mouth of the ureter, or the two ureters may be catheterized.

The bleeding has certain characteristic features to distinguish it from other forms of hæmorrhage. It comes on suddenly and without any assignable cause, is uninfluenced by treatment, and ceases without any apparent reason.

The hæmorrhage usually occurs early in the disease, but sometimes the tumor exists for some years unnoticed, and the patient's attention is only called to it by a free hæmorrhage.

Cachexia is a constant symptom and occurs in nearly every case. The emaciation is marked, and on inspection it is evident that the patient is suffering from a serious affection.

The presence of a tumor is, of all, the most certain symptom, and it can usually be felt under the free border of the ribs. It is often possible to decide by palpation whether its surface is smooth or lumpy, and also its approximate size.

The tumor may be confounded with other organs in the neighborhood, such as the liver, gall-bladder, intestine, spleen, ovaries, ureters, and large utero-peritoneal lymph-glands.

If the cancerous deposits consist of small nodes lying deep within the kidney tissues, they cannot be felt; or the kidney may be so high up behind the ribs that it cannot be palpated.

It will be seen then that the disease must be well advanced before the tumor becomes large enough to be easily felt.

Varicocele.—Guyon calls attention to the rapid appearance of a varicocele on the affected side, due to pressure of the tumor on the spermatic veins. This symptom is very inconstant.

Pains in various bones are often noticed late in the disease, and are usually due to metastatic deposits in the bones. When these have occurred it is too late for any operative treatment to be of value.

DIFFERENTIAL DIAGNOSIS.

While a typical case of well-developed malignant disease of the kidney can be easily diagnosed by the presence of a tumor, cachexia, and hæmaturia, it is often difficult to differentiate beginning malignant disease from other conditions which may give rise to hæmaturia.

Idiopathic or essential renal hæmaturia may originate from various causes, which have been classified by Keyes [1] as follows:—

1. Hæmaturia—Scurvy purpura.
2. Drug-poisoning (turpentine, cantharides, etc.).
3. Parasites (*e.g.*, distoma, hæmatobium—Sondern).
4. Acute or chronic febrile diseases (scarlet fever, malaria).

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[1] Surgical Diseases of the Genito-Urinary Organs, 1903.

5. Surgical diseases (hydronephrosis, nephrolithiasis, renal mobility).

6. The passage of urinary crystals.

7. Angioneurosis.

8. Chronic nephritis.

9. Traumatic rupture of the kidney.

A close study of the case may succeed in establishing a positive diagnosis; but we ought not to suspend our efforts to make a diagnosis merely because the hæmorrhage has stopped, for if the bleeding is due to cancer it will surely return, and when it does so the time for operation will very likely be past. Hence it is, that, after exhausting the ordinary means of diagnosis by palpation, cystoscopy, and catheterization of the ureters, microscopic and chemical examination of the separate urines, if there is still a doubt in the surgeon's mind as to the cause of the bleeding, it will certainly be better for the patient, to do an exploratory nephrotomy. If the condition of the kidney, on examination, makes it advisable, the operation can then readily be converted into a nephrectomy.

The prognosis, without operation, is bad, and unfortunately the diagnosis is often made after secondary deposits have occurred, when operation is, of course, useless.

For this reason the patient's life depends upon making an early diagnosis, and before metastasis has occurred in other organs.

The only **treatment** which can be considered is *nephrectomy*, provided there are no metastatic deposits in other organs, that the other kidney is functionally competent, and that the heart and general condition will admit of a severe operation.

METHOD OF EXAMINATION FOR SUSPECTED DISEASE OF THE KIDNEY.

History.—*Family history* of tuberculosis, cancer or gout.

Previous diseases.—Pulmonary or genito-urinary tuberculosis, gonorrhœa, stricture, cystitis, attacks of renal colic, passage of gravel-stone, vesical calculus. If an old man, enlarged prostate and retention of urine.

Present symptoms.—Pain; frequent urination, whether most marked by day or night, hæmaturia, pyuria, quantity of urine passed, variations in quantity, and fluctuations in amount of pus and blood.

Physical examination.—Palpation of kidney for tumor or tenderness.

Examination of urine drawn from the bladder, for reaction, turbidity, specific gravity, albumin, sugar, and urea.

Microscopic examination of centrifugated sediment for epithelial cells from kidney, casts, crystals, pus, blood, and micro-organisms.

DIFFERENCES IN URINES OF CYSTITIS AND PYELITIS.

Cystitis.	*Pyelitis.*
Specific gravity, normal.	Specific gravity, low.
Reaction, alkaline.	Reaction, acid.
Albumin, scanty.	Albumin, greater quantity.
Pus, abundant.	Pus, less in quantity.
Casts, absent.	Casts, present.

Cystoscopic Examination of Bladder.—Exclude vesical calculus, tumors, cystitis, ulcerations of bladder, enlarged prostate. Note ureteral orifices.

Catheterize Ureters.—Examine right and left kidney urines, and compare.

Microscope.—Look for kidney epithelium, casts, pus, blood, crystals, and micro-organisms.

Chemical examination, for albumin, urea, and sugar, if phloridzin was injected.

Physical Examination.—Cryoscopy.

Radiographic picture, if calculus suspected.

Inject peritoneal cavity of guinea-pig, with urine from bladder or kidney if tuberculosis suspected.

Finally, if impossible to make diagnosis otherwise, **exploratory nephrotomy.**

A tabulation of the objective and subjective symptoms of renal lesions has been arranged as follows by Charles L. Gibson.[1]:—

Abnormal Mobility.—History: recognition of displacement by examition; associated neurasthenia and gastro-enteroptosis; direct and indirect pain.

Tumors.—Age; sarcoma in infancy, carcinoma in later life; cachexia; tumor; pain, hæmaturia.

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[1] Medical Record, January 7, 1905.

Hydronephrosis, Unilateral.—Antecedent history of blocking of one ureter, usually by a calculus; large, painless, rounded, fluctuating tumor in the loin; absence of constitutional and uræmic symptoms; compensatory hypertrophy of the other kidney.

Pyelonephritis or Surgical Kidney.—Usually history of long obstruction, plus infection; mostly elderly men with obstructing prostate and men in middle life with stricture; recognition of the obstruction and cystitis; a low-grade chronic sepsis; occasional acute exacerbations with chills and febrile disturbances; chronic diffuse nephritis; seldom any enlargement or tenderness of the kidney; usually bilateral.

Renal Calculus.—The passage of sand, gravel, or small calculi; typical renal colic; attacks of hæmaturia, especially if accompanying renal colic; symptoms of suppuration in the kidney; local pain and pyuria; recognition of an enlarged kidney due to pyelitis or hydronephrosis; excess of crystalline sediment; temporary oliguria followed by polyuria; gouty or rheumatic diathesis and chiefly in middle-aged individuals.

Hydronephrosis, Double.—History usually of chronic obstruction to the escape of urine from the bladder, or of malignant growth pressing on both ureters; recognition of the source of obstruction.

Pyonephrosis.—Antecedent history of infection and obstruction; large globular and fixed tumor in the flank, which is tender on pressure; if process was acute, febrile and other constitutional symptoms; pyuria, which resists all treatment of the bladder, and absence of all symptoms referable to the bladder.

Tuberculosis.—History of constitutional tuberculosis; other tuberculous foci, especially of the genito-urinary tract; persistent evening rise of temperature; very insidious and latent course of symptoms; polyuria from chronic diffuse nephritis; frequency of urination, even in earlier stages before marked changes in bladder; irregular hæmaturia without apparent cause; pus thoroughly mixed with urine of an acid reaction.

OPERATIONS ON THE KIDNEY.

1. Nephrolithotomy, or incision of the kidney for stone.
2. Nephrotomy, or incision of the kidney for exploration or drainage.
3. Nephrectomy, or removal of the kidney.
4. Nephrorraphy (nephropexy), or fixation of a movable kidney.

Before any operation is attempted on the kidney, an exact knowledge of the condition of both kidneys must be obtained by catheterization of the ureters.

The patient should be kept quiet for a few days, on light diet, the bowels freely opened with calomel and urotropin, and large quantities of water administered.

In exceptional conditions the kidney is exposed by a laparotomy, but ordinarily an incision through the lumbar region is to be preferred, as in this way it is not necessary to open the peritoneum.

Nephrolithotomy.

Nephrolithotomy is the operation by which a renal calculus is removed.

The steps are as follows:—

I. The Exposure of the Kidney.—The patient lies upon the sound side, [illegible]

[illegible] makes an incision, beginning [illegible] the last rib, which is carried [illegible] finger's-breadths of the [illegible]

[illegible] strong transversalis fascia [illegible] perinephritic fat becomes [illegible]

[illegible] and forceps, and [illegible] being recognized [illegible]

[illegible] kidney from its bed. [illegible] rotated and [illegible] the greater [illegible]

[illegible] finger is swept [illegible] the surgeon [illegible] case a violent [illegible]

[illegible] are very [illegible] indeed, [illegible]

[illegible] an assistant [illegible] abdomen. [illegible] assisted [illegible]

[illegible] may be [illegible] enlarged.

II. Detection and Removal of the Stone. [illegible] kidney has been [illegible] palpation [illegible] tion. If it is not found a needle must be pushed through the kidney tissues into the pelvis, to detect the calculus. Care must be taken not to puncture the renal vessels.

The pelvis of the kidney may also be exposed by making a small incision and enlarging it with the finger.

When the stone is touched, it may be cut down upon, either directly through the overlying kidney-tissue, or through its convex outer border, and removed with lithotomy forceps or scoop.

The ureter should then be explored by passing a probe from the pelvis of the kidney into the bladder, to make sure that a calculus is not impacted in it, and the operation is completed by replacing the kidney in its bed in the loin.

III. Treatment of Hæmorrhage and Closure of the Wound.—After the examining finger has been removed from the pelvis of the kidney, the hæmorrhage is very free, but soon ceases. If it continues, it may be controlled by packing gauze around the drainage tube which is inserted in the pelvis of the kidney, and making counter-pressure by packing gauze around on the outside of the kidney.

In very unusual cases the hæmorrhage is so free that it cannot be controlled by packing, and even a mattress suture through the kidney does not stop it. In such an event the only recourse is ligation of the renal vessels and ureters, and complete extirpation of the kidney.

Usually, the kidney is suppurating and the wounds cannot be sutured, but must heal by granulation. A rubber drainage tube is inserted into the pelvis of the kidney, with gauze strips alongside, and protrudes through the external wound, which is sutured around it.

IV. After-treatment.—Some surgeons advise taking the packing out of the wound in 48 hours, and repacking. It is, however, very difficult to repack the wound such a short time after the operation. It is often better to leave the packing in for 4 or 5 days, and, after the wound has begun to heal, the fistulous channel is well marked, and the packing can be easily replaced, allowing the wound to heal by granulation.

If high temperature, chills, or evidences of sepsis occur, the packing must be at once removed and the wound irrigated. The drainage tube must be taken out in a week, as, if left in too long, it may excite secondary hæmorrhage. Secondary hæmorrhage may occur from sloughing, and opening up a large vessel. It is announced by evidences of collapse, hæmorrhage from the wound and blood in the urine, and long, thin, worm-like clots from the ureter.

In many cases, if the bleeding continues, it is necessary to open up the wound promptly and remove the kidney.

Suppression of urine may occur from congestion of the other kidney. The indications are to relieve the congestion and start the secretion of urine by hot packs, saline infusions, dry cups over the kidney, and catharsis.

Nephrotomy.

The term nephrotomy is applied to the operation of exploring and examining the kidney through a wound in the loin, or of making an incision into the kidney for drainage.

The steps of the operation are the same as those described for nephrolithotomy.

In cases of **abscess of the kidney,** after the organ is exposed a fine grooved needle may be introduced at any suspicious spot. If pus escapes, a small incision should be made and the opening enlarged with the finger or forceps. The interior of the abscess cavity should be searched with the finger for communicating abscess cavities or pockets of pus, or an encysted calculus.

After the pus is evacuated the wound should be thoroughly irrigated and a rubber drainage tube introduced into the abscess cavity and the parietal wound closed around it.

In the presence of **cysts of the kidney** it is advisable to incise them freely after exposure, evacuate the contents, and explore their cavities for calculi.

The edges of the cyst should then be stitched to the skin-wound.

In cases of simple cyst, the wound heals by granulation.

When a **permanent obstruction in the ureter** exists, causing pyonephrosis or hydronephrosis, it is necessary to keep the pelvis of the kidney open and draining for a long time.

In order to accomplish this it is advisable to stitch the wound in the pelvis of the kidney to the margins of the skin-wound. The drainage tube is introduced into the pelvis of the kidney and the fistulous tract is kept open as long as drainage is required.

When it is known that the obstruction is a permanent one and the other kidney is healthy, it may be better to remove the kidney, and so save the patient the annoyance of a constant leaking of urine through the fistula in the loin.

Results of Nephrotomy and Nephrolithotomy.—The mortality of nephrotomy, for various conditions, can be noted by reference to Küster's collected statistics:—

For pyelonephritis, 92 cases operated, 17.39 per cent. died.
For renal calculus, 487 cases operated, 18.27 per cent. died.
For cysts of kidney, 150 cases operated, 6.66 per cent. died.

It is evident from these figures that the cystic kidney offers the best prognosis for operation, not because nephrotomy *per se* is less formidable than for other conditions, but the disease in itself is one which does not immediately threaten life.

Nephrotomy for calculus or pyelonephritis, on the other hand, is attended with a higher death-rate on account of the extreme damage to the secreting structures of the kidney, the depreciation of the patient's vitality, and the danger of prior involvement of the other kidney.

Nephrectomy.

By the term nephrectomy is understood a complete removal of the kidney. It is undertaken for malignant disease, primary tuberculosis, complete disorganization of the kidney through injury or suppuration, or permanent occlusion of the ureter.

Nephrectomy is a much more serious operation than nephrotomy, and is accompanied by greater shock. In consequence of this fact, it may be desirable to substitute a simple nephrotomy instead of a complete removal of the organ in the case of a patient who is greatly debilitated and who, it is feared, can not stand the shock of the more severe operation of nephrectomy.

For the same reason, in certain cases it is sometimes thought better to do a nephrotomy and drain the abscess for a few days, and after the patient has recovered strength sufficiently to admit of it, to perform nephrectomy, rather than to remove the kidney at the first operation.

The secondary nephrectomy should not be delayed too long, as after a time the adhesions become so firm that it may be impossible to extirpate the kidney.

Nephrectomy is usually performed by making an incision in the loin; but in exceptional cases, such as very large adherent tumors, the wound may be made through the anterior abdominal parietes (abdominal nephrectomy).

TECHNIQUE OF LUMBAR NEPHRECTOMY.

An incision is made in the loin and the kidney brought out of the wound, as described in nephrolithotomy.

I. Exposure of the Kidney.—If the kidney is very much increased in size, it may be found necessary to enlarge the incision, either by (*a*) extending it to the full length permitted by the conformation of the individual, or (*b*) by making a second incision, starting from the middle or posterior extremity of the original cut and running in a direction vertically downwards; (*c*) by extending the incision up over the two last ribs and excising their outer halves. These procedures almost double the size of the operative field.

If the adhesions are very firm, it may be impossible to separate the kidney from its surroundings and bring it out upon the flank.

In such a case the kidney may be enucleated with a periosteal elevator, from the thickened and adherent capsule, which is left behind with the pedicle.

II. Treatment of the Pedicle.—After the kidney has been freed and lifted out of the wound, an aneurism-needle threaded with a double silk ligature, should be passed between the ureter and the vessels, tying the pedicle firmly in two halves. The pedicle is then divided with scissors close to the kidney.

When the pedicle cannot be easily reached and ligated, it may be compressed firmly with a heavy clamp, cut through, and after the kidney is out of the way the pedicle can be tied.

If the stump of the pedicle is suppurating, it should be curretted and may be brought up into the parietal wound and held there by a suture.

III. Closure of the Wound.—Search should be made in the wound for bleeding points, which may be found and ligated; but if this is not possible, a firm packing of the wound with gauze will usually control the hæmorrhage.

If there is no bleeding, a gauze drain should be inserted to the bottom of the wound and the incision closed around it with silkworm gut.

Results.—In no class of surgical cases is the reduction of mortality, due to improved operative and diagnostic technique, more striking than in operations on the kidney.

The stastics as presented by Küster[1] are most instructive. In the years 1861 to 1869, nephrectomy was done on 5 patients, with a mortality of 80 per cent.

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[1] Chirurgie der Nieren, 1902.

In 1882, Harris reported 50 cases, with a mortality of 38 per cent.; while in 1902 the collected reports of Küster on 1067 cases of lumbar nephrectomy show a reduction in the death rate to 12.08 per cent.

Küster's records also show that nephrectomy by the abdominal route has a mortality of 34 per cent., or nearly three times as great as when the operation is done through the loin without opening the peritoneum.

Nephrorraphy (Nephropexy).

This operation is performed to prevent the excursions of a movable kidney, and depends for its success upon the formation of firm organic adhesions between the kidney and the surrounding structures.

The kidney is exposed through the usual incision in the lumbar region, the fatty capsule is incised and torn through, and the true fibrous capsule of the kidney exposed.

The kidney is then fixed to the edges of the wound by sutures of chromicized catgut, kangaroo tendon, or sterile silk.

The technique of anchoring the kidney to the abdominal wall is very varied. The methods in use by different surgeons are as follows[1]:—

(*a*) The sutures are passed through the *fibrous capsule* of the kidney and the muscular edges of the wound. (Vulliet.)

(*b*) The sutures are passed through the *parenchyma* of the kidney, without stripping the capsule. (Albarran, Henry Morris.)

(*c*) The capsule of the kidney is split and *dissected off* the surface of the parenchyma, sutures are passed through the *fibrous capsule* and the *muscular borders* of the wound, and the wound is closed by sutures.

(*d*) The fibrous capsule is split and stripped, and sutures are passed through *the capsule and through the parenchyma* of the organ, including the wound-edges, and the wound is *closed by sutures*. (Tuffier.)

(*e*) The fibrous capsule is split and stripped from the surface of the kidney; its edges are sutured to the edges of the wound, and gauze packing is introduced down to the exposed surface of the renal parenchyma; the upper and lower angles are closed by suture, and the central portion of the wound *is kept open* by repeated packing, so that a firm mass of scar-tissue is formed between the kidney on the one hand and the abdominal wall on the other.

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[1] Johnson, Medical Record, March 19, 1904

The quantity of packing introduced into the wound is gradually diminished and the wound allowed to close in from four to six weeks. (Riedel, Kocher.)

The results of these various methods will probably be found to compare favorably one with another, although Henry Morris, Tillmanns, Tuffier, Keen, and others believe that passing the sutures through the parenchyma of the organ furnishes a larger percentage of successes than other methods of procedure.

The mortality of the operation is very slight, running from 2 to 4 per cent. when it is performed under favorable auspices.

According to Albarran, in 88 per cent. of the cases which recovered, the pain was cured. In 14 per cent. nervous symptoms were partially cured; but 36 per cent. were not benefited in this respect.

Keen reports 134 cases of nephrorraphy, and of the cases treated by suture of the fatty capsule only 26.6 per cent. were failures; of those treated by suture of the fibrous capsule alone, 25.9 per cent. were failures; while in those treated by suture involving the kidney substance, only 13.5 per cent. were failures.

RENAL DECAPSULATION IN BRIGHT'S DISEASE.

Within very recent times the interest of surgeons has been strongly directed toward the cure of chronic nephritis by stripping off the capsule of the kidney.

A brief history of the development of the operation may not be out of place.

In 1896, R. Harrison[1] reported 3 cases of patients suffering from nephralgia and hæmaturia, where the kidney was cut down upon in the expectation of finding a renal calculus or pyelitis. No obvious cause for the symptoms was discovered, but the pain, hæmaturia, and albuminuria disappeared after the nephrotomy, and the patients completely recovered.

Harrison attributed the success of the operations to the relief of tension, accompanying the inflammation of the kidney, which followed a division of the kidney.

He also drew the conclusion that interference with an inflamed kidney on one side benefited the function of the other, and explained it by assuming that there was a sympathetic connection between the two kidneys.

Israel[2 3 4 11] also reports cases of unilateral hæmaturia or nephralgia, upon which he did nephrotomy, which were supposed to be due to calculus, but were in reality cases of chronic Bright's disease.

Of 14 cases which he operated upon, 2 died of severe double nephritis, and 6 recovered completely. In 3, the symptoms recurred after prolonged intervals, and in two the nephrotomy was a failure.

Israel disclaims any intention of curing chronic Bright's disease by operation, in general, and regards nephrotomy as indicated only in cases of hæmaturia and nephralgia where the symptoms become severe and medically uncontrollable.

He believes that the relief of the symptoms is due to a lessening of the intrarenal pressure within an unyielding capsule, which interferes with or suppresses blood-circulation and urinary excretion.

He accounts for the disappearance of all the symptoms when only one kidney has been operated upon, by assuming that the disease is confined to one kidney and that the other is healthy.

He calls attention to the well-known fact that a tissue which is the seat of chronic inflammation usually takes on healthy action when the diseased structures are split, and he believes that after nephrotomy new venous channels form between the kidney and surrounding structures, in this way relieving congestion and lessening the intracapsular pressure.

Pousson[5 6] also reports cases of chronic Bright's disease where nephrotomy was done by himself and others.

He explains the good results obtained, by assuming that the nephrotomy relieves the pressure and permits the secreting cells of the kidney which are still undamaged to resume their function.

Pousson, however, is of the opinion that nephrotomy should only be done in desperate cases of uræmia, where the usual medical treatment has entirely failed.

Edebohls,[7 8 9 10] of New York, was the first surgeon to operate on cases which had been diagnosed as chronic Bright's disease, with the object of curing that condition by operation.

While in England, France, and Germany, surgical measures were undertaken for the relief of renal hæmaturia and pain, or of desperate cases of uræmic poisoning, in this country Edebohls conceived the idea from his work in anchoring movable kidneys, and observing the improvement which occurred in the accompanying nephritis.

His next step was to operate primarily for the cure of nephritis in cases where the kidney was not movable, by stripping off the capsule of the kidney instead of merely doing nephrotomy, as has been the practice of the European surgeons.

As to the *modus operandi* by which renal decapsulation exerts a favorable influence on chronic Bright's disease, Edebohls believes that by removing the impervious capsule of the kidney an opportunity is created for the formation of new vascular connections, between the blood-vessels supplying the secreting structures of the kidney on one hand, and the blood-vessels surrounding the kidney on the other.

Edebohls made his first observations on 3 cases that had been operated on for nephropexy. He noted that the strong connective-tissue adhesions, or bands, attaching the kidney to its surroundings, contained large and numerous blood-vessels, running between the kidney and its adjacent tissues.

The newly-formed arteries predominated in size over the veins, and in all the arteries the direction of the blood-stream was *toward* the kidneys.

Edebohls believes that the increased blood-supply leads to an absorption of the interstitial or intertubular exudates, freeing the tubules from compression and promoting a re-establishment of the normal circulation, with regeneration of epithelium capable of carrying on the secreting function.

The views of pathologists are strongly opposed to these explanations.

Van Cott and Murray[12] in their experiments on dogs in the Hoagland Laboratory, found that after stripping the capsule, a new, thick capsule was formed, with capillary and not arterial anastomoses. They also state that the elaborate researches of Marchand, Barth and others prove that where extensive destruction of the renal tissue occurs, repair is imperfect, and never to the degree of a restoration of functional activity.

Johnson[13] also found, in his experiments on dogs, that the new capsule which formed was thicker than the original one, and without anastomoses between the renal and perirenal vessels.

It is thus evident that clinicians and laboratory workers are at variance in explaining the anatomical basis of improvement after decapsulation.

Pel, Jaboulay, and others have suggested that the improvement comes more from the reaction of the operation upon the sympathetic ganglia, rather than from the increased blood-supply to the part.

The first beneficial effects of the operation do not appear before the tenth day, and are explained by Edebohls as probably due to the manipulation of the kidney during the operation, which acts as massage and stimulates its natural blood-supply.

He also states that the new capsule forms in from 3 weeks to 3 months after stripping; that it is sometimes thicker and sometimes thinner, but always more succulent and vascular than the original.

The *classification* of chronic Bright's disease varies greatly with different authorities, and is more confused by the fact that different pathological lesions always exist at the same time and in the same kidney.

Edebohls classifies as *interstitial nephritis* those cases in which inflammation of the connective tissue predominates; *parenchymatous nephritis,* in which involvement of the secreting apparatus forms the salient feature; and as *diffuse nephritis,* in which both parenchyma and connective tissue are equally involved.

The knowledge that a unilateral chronic nephritis can exist is a fact which has been unknown until very recently. Out of 72 cases of chronic Bright's disease operated upon, Edebohls found that in eleven cases one kidney alone was affected.

Unilateral disease of the kidney was found to exist more frequently among the milder and less advanced cases, for as the disease progresses the other kidney becomes involved as well, so that Guiteras[10 15] found, in looking over the autopsy reports in 500 cases of chronic Bright's disease, that in not one instance could it be said that the nephritis was unilateral.

The length of time elapsing before the involvement of the second kidney probably explains the chronic course of many cases of chronic Bright's disease, in which the general health suffers but very little. The healthy kidney does the eliminative work for both organs, and uræmia does not occur until the second kidney becomes badly disorganized.

As to the **indications for renal decapsulation,** Edebohls regards as suitable any patient with chronic Bright's disease, who has a reasonable expectation of not less than a month of life without operation and who can stand the administration of an anæsthetic. As the beneficial results of the operation do not appear for 10 days, the above proviso is made.

In itself, the operation of renal decapsulation is one in which the danger to life is very slight, if undertaken before cardiac and vascular changes have occurred.

This is shown by Edebohls in his results in cases of nephropexy. He decapsulated and anchored both kidneys in 73 cases, with only one death.

Among the **contraindications** which bar out operation may be considered, first, dilatation of the heart, which predominates over hypertrophy, accompanied by *insufficiency of the aortic valves,* with an intermittent aortic regurgitant murmur with every third or fourth beat.

In such a case there is danger of death from a general anæsthetic.

A certain degree of cardiac hypertrophy and degeneration goes with every case of chronic Bright's disease, but does not, in itself, constitute a contra-indication.

Indeed, in several of Edebohls' cases, cardiac hypertrophy disappeared after decapsulation.

When, however, the cardiac and vascular changes have very extensively advanced, the dangers of the operation are so greatly increased that it is not worth the patient's while to take the risk.

When *retinitis albuminurica* is present, it shows that extensive vascular changes have taken place through the body, which in themselves will prove fatal in a short time, even though the kidney function be restored.

In 67 per cent. of the cases the patients will die in a year, while of the remainder none will survive over the second year.

Guiteras also looks unfavorably upon patients who are suffering from general anasarca with a bad heart, for statistics show that 50 per cent. die after operation, 25 per cent. are improved and finally die, and only 25 per cent. are improved or cured.

Chronic diffuse nephritis is the most unfavorable form of operation, as 75 per cent. of these die.

Many of them were suffering from general anasarca; nearly all were uræmic, and most of them œdematous.

TECHNIQUE OF OPERATION.

It is always advisable for the patient to rest in bed for a week before the operation, as the heart is usually diseased in cases of chronic Bright's disease; and favoring the organ improves its condition. Rest in bed also lessens the amount of waste material for the kidneys to excrete, and the time can be utilized for the chemical and microscopical examinations of the urine, for regulation of the food and drink, for administering urotropin, and cardiac and vascular regulators, like strychnine, digitalis, nitroglycerine, etc.

The proper preliminary preparation of a patient adds materially to the chances of a successful result.

In the less advanced cases catheterization of the ureters, or segregation of the urine, should always be employed, to determine if the disease is unilateral or not.

The operation of *excision of the renal capsule* is performed as follows:—

The patient lies prone on the table, with Edebohls's kidney air-cushion underlying and supporting the abdomen. Both kidneys are thus rendered accessible, without changing the position of the patient.

The incision is made from the twelfth rib to the crest of the ilium, along the outer margin of the erector spinæ, without opening the sheath of the muscle. The peri-renal fat is exposed and separated from the kidney. The kidney is then lifted out of its fatty bed and delivered through the wound.

The capsule proper is then divided in a direction around the entire convex border of the kidney, each half of the capsule is stripped from the kidney and reflected towards the pelvis, until the surface of the kidney is raw and denuded.

The stripped-off capsule is next cut away and entirely removed. The kidney is then dropped back into its fatty bed, and the incision is closed without drainage. If the kidney was movable before the operation, it should be anchored with sutures to the muscles of the back; but this procedure is only necessary when it was movable.

For an anæsthetic, Edebohls uses ether, preceded by nitrous oxide; and in cases where the Bright's disease is far advanced, he suggests the use of spinal anæsthesia with cocaine.

RESULTS OF OPERATION.

Guiteras[15] collected statistics of 150 cases operated upon by various surgeons. He found of these 16 per cent. were cured, 40 per cent. improved, 11 per cent. unimproved, and 33 per cent. died.

In cases of interstitial nephritis, Guiteras states that the results often appear brilliant, as the albumin and casts disappear from the urine, but the amount of solids excreted remains the same.

The mortality in chronic interstitial nephritis was 26 per cent., in chronic parenchymatous, 25 per cent., and in chronic diffuse, 75 per cent.

Death was occasioned by the following causes: exhaustion, uræmia, coma, œdema of the lungs, acute dilatation of the heart, asthenia, apoplexy, and exacerbation of chronic nephritis.

Edebohls[16] [17] sums up the results in 72 cases, which he operated upon within the past twelve years, as follows:—68 operations on both kidneys, and 4 operations on one kidney only. Seven patients died within two weeks following operation, 13 died ultimately of chronic nephritis or its complications, and 9 died of causes other than nephritis. Three patients were unimproved; 20 are in various stages of satisfactory improvement and progress toward health, at periods varying from 2 months to 12 months after operation. The urine of several of these is free from albumin and casts.

Seventeen patients were cured of chronic Bright's disease, and remained cured at periods after operation varying from 1 year and 9 months to 12 years.

Three patients disappeared and could not be traced.

In the foregoing account the author has endeavored to give the present status of the cure of Bright's disease by renal decapsulation, as taken from the various writings upon the subject.

The operation is yet much too recent to express a positive opinion upon its value, and time alone will show whether we have found another means of prolonging life by surgical operation in a condition which until now has been hopeless.

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DISEASES OF THE TESTICLES.

CHAPTER XVII.

ECTOPY OF THE TESTICLE.

THE testicles are developed in the abdominal cavity of the fœtus. About the fifth month of fœtal life they begin to descend, and pass through the inguinal canal into the scrotum, arriving there about a

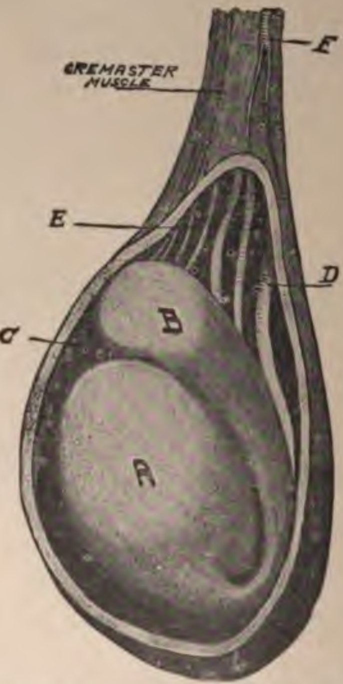

Fig. 130.—Testicle and Epididymis Exposed by Cutting away Part of the Tunica Vaginalis.

A, Testis.
B, Epididymis.
C, Tunica Vaginalis.
D, Vas Deferens.
E, Spermatic Artery and Veins.
F, Artery of Cord.

month before birth. One or both testicles may fail to follow the normal course, and may be retained:—

(*a*) In the abdomen (cryptorchism).

(*b*) In the inguinal canal.

(*c*) The testis may take an aberrant course and may be found lodged under the skin of the abdominal wall, the thigh, or perineum.

ETIOLOGY.

The causes which operate to prevent the normal descent of the testis are obscure. It may be accounted for, however, by assuming that the external inguinal ring is of too small a size to allow the testicle to pass through it, or that the vessels accompanying the spermatic cord are too short to allow the cord itself to be stretched sufficiently to allow the testis to reach the bottom of the scrotum. If the testicle is held by a long mesorchium in the abdominal cavity its mobility may be so great that it slips past the opening of the inguinal canal without entering it.

The wearing of a truss, on account of a hernia, in a case where the descent of the testicle has been delayed after birth, will also prevent the testis from arriving at its normal place in the scrotum.

The causes of cruro-femoral and perineal ectopy are still more obscure. It is thought, however, that an overdevelopment of certain bands of the gubernaculum will have the effect of drawing the testis to one side and thus occasioning its aberrant course.

RESULTS.

The results of ectopy are impairment of the growth and development of the testis, so that it remains undersized, but probably possesses the power of forming spermatozoa, unless its structure is destroyed by attacks of inflammation, which are very liable to occur. After the testicle has been disorganized *sterility*, of course, follows.

COMPLICATIONS.

Hernia is a very frequent accompaniment, and if the testicle lies in the inguinal canal it interferes with the wearing of a truss, so that strangulation of the hernia is very liable to occur.

The testicle when not lying protected by the thighs, in the scrotum, is very liable to be struck and bruised, and the ectopic testicle rarely escapes several attacks of traumatic inflammation.

It is also subject to gonorrhœal inflammation from extension of a gonorrhœa from the posterior urethra.

Malignant disease is very apt to occur in the ectopic testicle, and is predisposed to by the attacks of inflammation to which the testicle in this situation is so liable.

DIAGNOSIS.

The diagnosis is made by (*a*) the absence of the testicle from the scrotum; (*b*) the detection of a smooth, oval, soft tumor in the inguinal canal, which moves up and down when the patient coughs and strains.

The testicle should not be mistaken for a hernia, which often complicates this condition.

TREATMENT.

In *intra-abdominal ectopy* or cryptorchism, it is impossible to rectify the condition by operation, as the spermatic cord is too short to admit of placing the testis in the scrotum.

In addition, as the testicle is protected from traumatism, inflammation does not occur in it, and the dangers of destruction of its function, with consequent sterility or malignant degeneration, do not occur, and the chief reasons for operation do not exist.

In *inguinal retention* it is often possible by means of gentle manipulation to push the testicle into its proper place in the scrotum, and it may be retained in position by wearing a proper truss, which closes the ring and prevents its return.

If this procedure fail to retain the testicle in place, and the child is over six years of age, a surgical operation should be performed, for the reason that the testicle does not reach its full size and functional development while in an abnormal situation. From its exposed location it is also constantly liable to blows and injuries. These lead to repeated attacks of inflammation, causing sterility, and also predispose to malignant disease. The selection of the operation will depend upon the history of the case. An operation to replace the testicle in the scrotum is only advisable *before* the occurrence of attacks of inflammation. After attacks of inflammation have occurred, the secreting structure of the testicle is destroyed, and the organ is rendered useless and only liable to disease. On this account *castration* is indicated, and at the same time the inguinal canal may be examined, and, if hernia is also present, it may be radically cured and the canal closed.

MALIGNANT DISEASE OF THE TESTICLE.

It is difficult to draw a distinction between benign and malignant growths of the testicle, because histologically the tumors are nearly always mixed formations composed of fibrous, myxomatous, sarcomatous, and cartilaginous elements associated together, and tumors of the testicle which are apparently innocent are often followed by secondary deposits in the adjacent lymphatic glands and other organs.

VARIETIES AND CLASSIFICATION.

Sarcoma may be composed of spindle or round cells, or may, in its early stages, appear as numerous small cysts, filled with clear or dark fluid, scattered through the substance of the gland.

Carcinoma is usually of the soft, or encephaloid, variety.

Lymphadenoma, chrondroma, fibroma, myxoma, and osteoma are also occasionally met with.

The clinical history of sarcoma and carcinoma, which are by far the most common forms, may be considered together.

The *age* at which the disease usually appears is from fifteen to forty-five years, but sarcoma is occasionally found in very young children.

The disease begins in the glandular epithelium of the tubes or in the connective tissue between the tubes, and increases in size, involving the whole of the body of the testicle.

The tumor formed is smooth and uniform, until the tunica albuginea breaks down, and after this occurs the growth feels irregular or nodular, with areas which are soft and fluctuating. The tumor increases more rapidly in size after rupture of the tunica albuginea and often becomes enormous. The skin of the scrotum sloughs and allows part of the testicle and granulations to protrude through the opening, forming *fungus testis.*

The spermatic cord enlarges from the infiltration of its tissues by the new growth, and the adjacent lymphatic glands become infected and enlarged.

The veins of the scrotum swell, and the lower extremities become œdematous from the pressure of the pelvic and lumbar glands upon the iliac veins.

The general health fails, the patient becomes cachectic and emaciated and death results in one or two years after the first appearance of the growth.

PROGNOSIS AND TREATMENT.

The great majority of tumors of the testicle are either malignant, tubercular or syphilitic, and it is always desirable to try the effect of inunctions of mercury and large doses of iodide of potash, for ten days, if there is any suspicion of syphilis.

If there is no improvement at the end of that time, *castration* should at once be performed.

If this is done early enough, the disease may be permanently cured, but unfortunately it is not uncommon for the lymphatic glands in the pelvis to be involved, and a recurrence of the disease often takes place within a year after the operation.

TUBERCULOSIS OF THE TESTICLE.

The testicle is frequently the seat of tuberculosis, which always begins in the epididymis and may subsequently involve the body of the testicle.

The epididymis may be affected (*a*) primarily, which is most frequent; (*b*) secondarily from a tubercular deposit in one of the other genito-urinary organs; or (*c*) in consequence of a general tuberculosis.

CHANNELS THROUGH WHICH TUBERCLE BACILLI ARE CONVEYED TO THE EPIDIDYMIS.

When the epididymis is affected primarily, the bacilli are introduced into the general blood-circulation and carried directly to the epididymis by the spermatic artery.

When the infection in the epididymis is secondary it is frequently derived from the seminal vesicles. These are often affected by tuberculosis, as the result of tubercle bacilli which were introduced into the urethra during coitus.

After the tubercular process is established in the vesicles, the bacilli are carried along the vas deferens and lodge in the epididymis.

If the tuberculosis in the epididymis is derived from the bladder, prostate or other adjacent organs, the infection is usually carried by means of the lymphatics.

There are certain *predisposing causes* to tubercular infection, such as a hereditary tendency to consumption and such local causes as the prolonged congestion from erotic excitement, an attack of gonorrhœa, or slight traumatism. These causes all probably operate in the same way, by lowering the resistance of the tissues and permitting the tubercle bacilli to take effect.

The time of life at which the testicle is most likely to be attacked is during its period of activity, from the age of puberty until past the fiftieth year.

COURSE.

One or two small nodules form in the head of the epididymis. Occasionally they remain latent for years or may become encapsulated and converted into fibrous tissue. As a rule, however, the

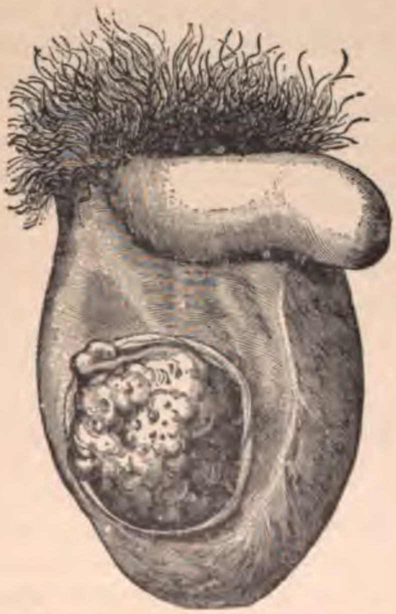

Fig. 131.—Hernia or Fungus Testis.

nodules grow and coalesce until the whole epididymis is so much enlarged that it surrounds the testicle. After a time the tubercular mass softens, becomes cheesy, and breaks down.

The skin of the scrotum lying over the nodules is attached to the testicle, glued fast by the inflammatory adhesions, and the pus is discharged through an opening in it from the tubercular abscess, leaving a fistula.

The disease seldom limits itself to the epididymis, but if left alone, spreads to the testicle. This occurs in three-fourths of the cases, as shown by autopsy.

After the abscess in the epididymis or testicle has opened, a considerable amount of attached skin, lying over the nodule, may slough away, leaving an opening in the scrotum through which a mass of new granulation tissue, growing from the testicle or tunica albuginea, may protrude, forming *hernia testis*, or *fungus testis.*

In the earlier stages of the disease, before abscess-formation, the *tunica vaginalis* is affected by the inflammation, and, if an excess of fluid is secreted by its walls, hydrocele may be present.

On the other hand, adhesive inflammation may take place, and the sac of the tunica vaginalis become obliterated.

Occasionally purulent collections containing tubercle bacilli are found in small cavities, circumscribed by the adhesions.

The *vas deferens* is always affected in time, and shows small localized nodules in its continuity, which are most liable to be located at its extremities,—*i.e.*, near the seminal vesicle and the epididymis,—the intermediate portion being free.

More rarely the cord is uniformly thickened, with a general diffuse tubercular infiltration.

The other testicle in time becomes affected, and the disease runs its usual course.

Although tuberculosis of the testicle usually runs a very slow and insidious course, the nodules developing gradually until the formation of pus, rare cases are occasionally met with in which the disease runs a very acute course, called by Réclus, **galloping consumption of the testicle.**

The nodules which had existed quietly for a time from some cause take on a very rapid growth, and caseation and abscess-formation occur in about three weeks. In this form the testicle itself is always attacked, and it is usually accompanied by a purulent urethral discharge containing tubercle bacilli. The discharge may originate spontaneously or it may begin as a gonorrhœa from infection with gonococci during coitus.

SYMPTOMS AND DIAGNOSIS.

Tubercular nodules may exist in the epididymis—remain latent for months—without causing any discomfort, and, if discovered, they are usually found accidentally.

Discomfort does not occur until inflammation begins, with its pain, swelling, and subsequent abscess-formation.

In the early stages examination shows one or more small nodules of a peculiar stony hardness to touch, located in the head of the epididymis and along the cord.

Later in the disease, after the nodules have become cheesy or broken down, the skin is found to be adherent over a circumscribed tumor, with hard walls and a central softening, which may yield fluctuation if pus is present.

Although the nodule may be actually located in the epididymis, the enlargement of this part of the organ is so great that it may surround the body of the testicle, giving rise to an appearance as though the nodule were in the testicle itself.

Suspicions as to the tubercular nature of a growth should always be aroused by the history of an epididymitis coming on without any apparent cause or after a slight injury, and, if hard nodules are found in the seminal vesicles or prostate, the diagnosis of tuberculosis is sufficiently established, and may be confirmed by finding tubercle bacilli in the contents of the cheesy nodules.

Under treatment the severe inflammatory symptoms of epididymitis quickly subside, and are usually followed by a general softening of the tumor and formation of abscess, differing in this way from a simple epididymitis, which, after it is over, leaves a hard and thickened epididymis.

PROGNOSIS.

It is a very rare occurrence for tuberculosis of the testicle to become permanently cured without operation, even under the most favorable climatic influences.

When a cure does occur, it is through a process of encapsulation and fibroid degeneration, but it often happens that the process of encapsulation only closes up the infective material for a time, and under favoring conditions the deposit again becomes active and continues its usual course of caseation, abscess-formation, and infection of remote organs.

Tubercular nodules, however, may remain latent for many years before abscess forms, or until a slight traumatism or attack of gonorrhœa stirs them into activity.

After suppuration the disease runs a rapid course, and leads to a fatal termination, either by inducing tuberculosis in some other organ or by the exhaustion and fever incident to the occurrence of suppurating fistulæ.

TREATMENT.

Palliative measures are, unfortunately, only applicable to people of means, who are able to lead an out-of-door life or take a long sea-voyage, and who can have constant medical supervision. Such measures may retard the caseation of the nodules if begun in the earliest stage while the deposits are small and hard.

As soon as the deposits begin to soften and become cheesy, surgical measures should at once be resorted to, as waiting for resolution, which never occurs, is only a waste of valuable time, and allows the extension of the disease to remote organs.

In the case of hospital patients, who are poorly nourished and badly housed, and who cannot have suitable climatic surroundings, the nodules should be removed at once.

OPERATIVE TREATMENT.

Erasion, or curetting, is the operation which is applicable to the cases where one or two small nodules exist in the epididymis. The softened area should be opened and the contents well scraped out with a sharp spoon, iodoform rubbed in, and the cavity packed and allowed to heal by granulation.

Castration is the operation best adapted to the advanced cases. The indications for its use have been summarized by Jacobson as follows:—

(*a*) When erasion has failed in lesions of the epididymis.

(*b*) When discharging fistulæ are present or are numerous.

(*c*) When, after erasion, persistent swelling of the testicle accompanied with night-sweats and loss of flesh is present.

(*d*) When fungus testis exists or when the body of the testicle is involved.

(*e*) In the presence of purulent hydrocele.

Castration is used in two different classes of cases:—

Class A.—In *primary* tuberculosis, when the disease is limited to one testicle and has not extended too high along the cord, and when the bladder, prostate, and vesicles are not affected. In such a case a reasonable hope may be entertained that the disease may be permanently eradicated from the body. If the seminal vesicles are affected the indication for castration is not so clear, although if the deposits are small and of recent date and the patient's general condition favors rapid healing, removing the testicle with its diseased nodules may retard the development of the tubercular foci located elsewhere.

Class B.—In cases where other organs of the body are tubercular and a cure is impossible, hygienic measures alone are the only treatment applicable. An exception should be made to this rule when the testicle is disorganized and the scrotum riddled with sinuses discharging pus. Here castration is indicated to relieve the patient from the drain of the exhausting discharges and from one source of his discomfort.

In the operation of castration the infiltrated skin and the cellular tissue should be removed. The spermatic cord should be divided as high up as possible, if necessary laying open the inguinal canal and removing the cord as far as the internal ring.

The cord should be tied with a double ligature through it, as a single ligature is liable to slip off and cause fatal hæmorrhage.

SYPHILIS OF THE TESTICLE.

The testicle is attacked by syphilis in the late secondary and tertiary periods, which presents itself in **two forms**:—

(a) Interstitial or diffuse form consists in an infiltration of the connective tissue between the tubules, which becomes converted into a hard, fibrous induration, compressing and destroying the tubules and an atrophy of the entire organ results.

(b) Circumscribed or gummatous form is a deposit of gummatous nodules varying in size from a pin-head to a hen's egg. After they have enlarged to a considerable size the mechanical compression of the cortex causes a cheesy degeneration of the substance and a contraction of the nodule; or the center becomes softened and is discharged through an ulcerated opening in the skin of the scrotum.

The epididymis may be involved secondarily in both forms, and hydrocele usually occurs from an effusion of fluid into the sac of the tunica vaginalis.

SYMPTOMS AND COURSE.

The body of the testicle enlarges slowly and insidiously, without causing any pain, and it often becomes as large as an orange.

In *shape* its outline is regular, although the protuberance of a circumscribed gumma may sometimes be felt. Its consistence is dense, and it feels heavy. The spermatic cord, as a rule, is not thickened.

The scrotum is not affected until after the gumma breaks down, when it becomes adherent, inflames and ulcerates, and *fungus testis* forms.

The disease is seldom bilateral at the beginning, but the other testicle may be attacked later.

Sterility only results from advanced disease in both organs, as a part of the secreting substance of the gland is spared.

DIAGNOSIS.

Syphilitic testicle is liable to be mistaken for tuberculosis, neoplasms, gonorrhœal epididymitis or hæmatocele.

The distinguishing points in syphilis are the regular outline and smooth, hard surface and the fact that the cord is not enlarged, and in addition the history of a past attack of syphilis.

The diagnosis may be confirmed by the effects of antisyphilitic treatment, and this should be tried in every case of tumor of the testicle before proceeding to operation, if there is the slightest question of a previous syphilitic infection.

PROGNOSIS.

Under appropriate treatment syphilitic infiltration is absorbed, and it is surprising to note how quickly large swellings disappear and the function of the testicle is restored.

In untreated persons—particularly in tubercular, alcoholic, and weakly individuals—the gummata break down and discharge and hernia testis follows, but even neglected cases, which present ulceration of the scrotum and large fungus testis, generally heal in from four to six weeks under antisyphilitic treatment.

TREATMENT.

The treatment consists in a general course of mercurial inunctions and the internal administration of iodide of potash in increasing doses, running it up to $^1/_2$ ounce per day, if necessary, to cause absorption of the newly-formed tissue.

HYDROCELE, HAEMATOCELE, AND VARICOCELE.

CHAPTER XVIII.

HYDROCELE.

BEFORE the testicle descends from the abdominal cavity in the fœtus, it is preceded by a process of peritoneum, which makes its way through the inguinal canal and forms a pouch in the scrotum called the *tunica vaginalis testis.* After the testicle has descended it lies *behind* the pouch, and is adherent to it.

Under ordinary conditions the opening in the pouch which formerly communicated with the abdominal cavity is closed. If it remain open, *congenital hydrocele* is said to exist. If the opening closes, the testicle is provided with a shut sac, lying in front of it and partly surrounding it, which serves as a protection against injuries, and allows of a certain freedom of motion.

ACUTE HYDROCELE.

ETIOLOGY.

Acute hydrocele is usually the result of a contusion of the testicle or a punctured wound of the sac of the tunica vaginalis. It may also occur from an extension of inflammation from the epididymis or testicle, occurring in the course of gonorrhœa or other infectious disease.

PATHOLOGY.

Its pathology consists in an accumulation of serous fluid, which is occasionally stained with blood in the sac, and a deposit of lymph upon its walls.

SYMPTOMS.

The symptoms consist in œdema and redness of the scrotum, accompanied by an elastic painful swelling, which is tender on pressure over the testicle.

If much fibrim is deposited, creptation is sometimes observed.

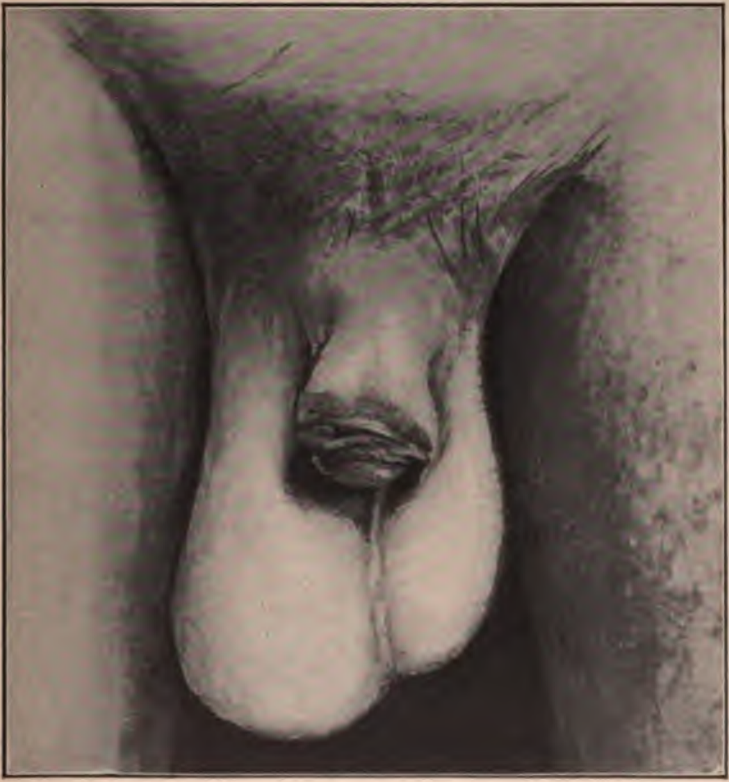

Fig. 132.—Hydrocele. (Author's Case, from Kings County Hospital.)

Acute hydrocele *terminates* either in (*a*) recovery in two or three weeks, with the formation of adhesions within the sac and a thickening of its walls; (*b*) in suppuration; or (*c*) it may become chronic.

TREATMENT.

The treatment consists in rest, with suspension of the scrotum and the local use of an ice-bag or hot application. After the acute symptoms have subsided the patient can walk about, wearing a suspensory bandage. If much fluid is present in the sac and tension is extreme, aspiration is required.

ACUTE PURULENT HYDROCELE.

It occasionally happens that a fibro-serous hydrocele becomes purulent instead of resolving, or suppuration may occur early as a result of an infected puncture of the sac, or an extension of a suppurative process from the testicle or epididymis.

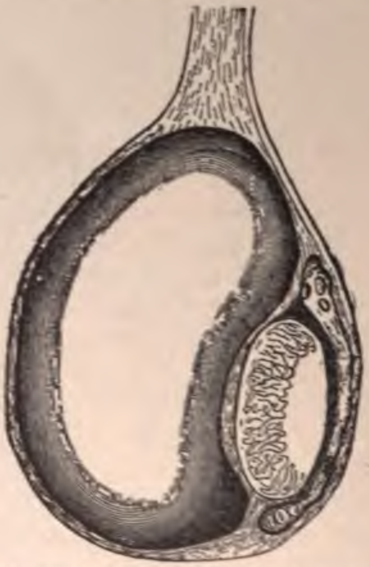

Fig. 133.—Vertical section of simple hydrocele.

In such a case the contents of the sac, instead of being clear serum, are composed of pus. Such a condition is apt to result in involvement of the peritoneum or a general septic infection, unless the pus is evacuated by a free incision and drainage.

CHRONIC HYDROCELE.

Chronic hydrocele is generally confined to one side, and ordinarily occurs between the twentieth and fortieth years, although children are occasionally born with it. It generally begins insidiously, although it may follow an acute attack.

It is supposed to be a mere passive process of transudation dependent upon the state of the blood-vessels and circulation, when it occurs as a primary disease.

PATHOLOGY.

The quantity of fluid which the sac contains is variable, from a few ounces to one, two, or even three quarts. Its color is usually clear and watery, but it may be greenish or bloody. It contains a large number of desquamated epithelial cells and leucocytes, it appears turbid, and blood gives it a reddish or brown color.

In rare cases the fluid is white, and resembles milk, from an admixture with lymph (hydrocele chylosa), and in the tropics and in cases of true elephantiasis, filiaria are found in the milk-like contents of the sac.

In long-standing cases of chronic hydrocele the tunica vaginalis is thickened, and may be calcified in portions, and the testicle and epididymis are hard and atrophied.

Sometimes adhesions form, and the sac is converted into a number of distinct compartments. In other cases small fibrous or fibrocystic bodies are attached to the wall or lie loosely within the sac.

SYMPTOMS AND DIAGNOSIS.

Hydrocele causes no symptoms except those which arise from the increase in size and weight of the scrotal enlargement.

On palpation, the tumor is found to be pear-shaped and elastic to the touch, dull on percussion, without impulse on coughing, and it cannot be reduced and returned into the abdomen.

Attention to these points will usually differentiate a hydrocele from a hernia, hæmatocele, neoplasm of the testicle, or a hydrocele of the cord.

An additional point in diagnosis is the *translucency* of the hydrocele when it is viewed through a tube with a candle placed on the other side of the scrotum.

Instead of using a candle, an electric hand-searchlight affords a convenient means of examining the hydrocele for the sign of translucency, and by moving the light over the surface of the tumor the outline of the testicle itself can often be made out.

This sign is not infallible, however, as the thickened walls of the sac or turbidity of its contents from pus or blood prevent the light from being transmitted.

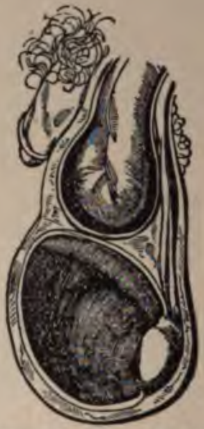

Fig. 134.—Hydrocele complicated by Hernia.

Fig. 135.—Electric Hand-searchlight.

As a last resource in diagnosis a suspected hydrocele may be aspirated with a fine needle, or the patient may be prepared for operation and the contents of the scrotum exposed by an incision.

TREATMENT.

The spontaneous healing of a hydrocele in an adult is such a rare occurrence that operation is always called for.

Puncture with a trocar may be regarded as palliative only, for the sac always fills up again with fluid in a short time.

Technique.—The scrotum is grasped in the hand and made tense, and after locating the position of the testicle, which is usually a little below and lying behind the sac, the trocar, with its point directed obliquely upward and inward, is thrust into the swelling, and the fluid is withdrawn.

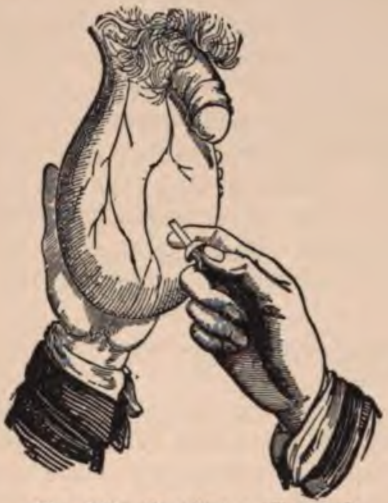

Fig. 136.—Tapping a Hydrocele.

Radical Treatment by Injection.—This is successful in many cases of hydrocele of moderate size and where the walls of the sac are not thickened, although it is more liable to be followed by a relapse than after incision.

The advantages of injection are, that no anæsthetic is required and the patient is only confined to the house three or four days.

Technique.—A hypodermic syringe is filled with 30 drops of pure carbolic acid, and the needle is introduced into the cavity of the sac. The hydrocele is then tapped with a trocar in the ordinary way, and the fluid is drawn off entirely. It is necessary that the sac should be completely emptied, for if fluid is left in, the carbolic acid is diluted, so that it does not produce the necessary amount of irritation, and if diluted it may be absorbed and cause poisoning.

After the fluid is drawn off the carbolic acid should be injected, through the hypodermic needle, which has remained *in situ,* and the carbolic acid is not withdrawn, but left in the sac. Inflammatory reaction is excited, but the exudate is gradually absorbed, and the sac becomes obliterated by the formation of adhesions between its visceral and parietal walls.

Incision of the sac is preferred to the treatment by injection in the following cases (Morris):—

I. When the sac is very thick, opaque, cartilaginous, or calcified.

II. If doubt exists as to whether the hydrocele is congenital or is a hydrocele of a hernial sac with a small opening into the peritoneum.

III. When a hernia complicates hydrocele and a radical cure of both is desired.

IV. When a loose or pedunculated fibrous body is present in the tunica vaginalis.

V. When organic disease of the testicle is suspected.

VI. When on account of ill health or lessened resistance the risk of inflammation after injection is especially to be dreaded.

There are three methods of performing the operation of incision:—

(*a*) *Volkmann's Operation of Simple Incision.*—In this procedure the sac is opened by a longitudinal incision through the scrotum, and after the fluid is evacuated the edges of the walls of the sac are stitched to the edges of the wound in the skin, to prevent leakage into the cellular tissue of the scrotum. The cavity of the sac is packed and allowed to heal by granulation, and in this way the sac becomes obliterated. The patient is able to get out of bed in a week, and the wound is healed by about the third week.

(*b*) *Von Bergmann's Operation of Incision and Excision of the Tunica Vaginalis.*—Tillmanns considers this the best radical operation. The sac is laid bare by a longitudinal incision, and by blunt dissection is freed from the cellular tissue. The redundant portion of the sac is then cut away with scissors from the testicle, but leaving enough of the wall of the sac to cover the testicle itself. The external wound is closed with sutures, and a dressing applied which will exert compression. The wound is cicatrized in from eight to twelve days. Relapses are more certainly prevented through excision than by other methods, and the wound heals in a very short time.

(*c*) *Doyen's Operation of Incision and Excision of the Sac.*—An excellent operative procedure recently suggested by Doyen for thin-walled hydroceles consists in incising the sac and everting the testicle so that it lies outside the sac. The wound in the sac is then sutured to prevent the return of the hydrocele, and the incision in the scrotum is closed without drainage.

The operation of simple incision of the sac is attended by the disadvantage of the prolonged time of convalescence.

Excision of a portion of the sac is sometimes followed by hæmorrhage, which is a free and continuous oozing from the cut edge of the sac, and which fills up the cavity in the scrotum, causing a hæmaturia. The oozing is best controlled by a running catgut suture around the edge of the sac at the time of the operation.

If the portion of the sac-wall which contains the nutrient artery is cut away, necrosis of the testicle follows.

Doyen's operation is especially adapted to thin-walled sacs, but may also be used in cases with thick walls, and these disadvantages can be thus obviated.

HYDROCELE OF THE SPERMATIC CORD.

(a) The cystic form is found as one or more small cysts, which form in the sheath of the cord, along its course between the testicle and the internal ring. The cysts are caused by an infusion of serous fluid into some part of the processus vaginalis, which was not obliterated after the descent of the testicle.

The cysts usually occur between the testicle and internal ring, and may extend so far down into the scrotum as to displace the testicle to one side: in a few cases the cyst lies within the inguinal canal.

Occasionally the cyst forming a hydrocele of the cord is not closed at either end, but communicates with the tunica vaginalis and also the peritoneal cavity (communicating hydrocele of the cord), and it is a frequent occurrence for the cyst to communicate with the sac of the tunica vaginalis testis. The cysts are shaped like an egg, and range in size from a pea to a hen's egg.

(b) The diffuse form of hydrocele of the cord is of extremely rare occurrence, and consists in an œdematous infiltration of the entire sheath of the cord, ceasing abruptly at the testicle below. The chief importance of hydrocele of the cord is from a diagnostic standpoint: in differentiating it from cryptorchism or hernia.

TREATMENT.

The use of injections of carbolic acid is attended with some danger, as the cyst may communicate with the peritoneal cavity and the carbolic acid may flow back into the abdominal cavity.

Operation is usually called for, and consists in division of the common sheath of the cord, in a longitudinal direction, and exsection of as much of the sac as can be separated from the cord. If the sac is found to be open, communicating with the peritoneal cavity, it is necessary to close the inguinal canal by suturing the upper edge to Poupart's ligament, as in Bassini's operation for hernia. If this were not done, the omentum and gut would subsequently descend through the patulous inguinal canal, and cause hernia.

HÆMATOCELE.

Hæmatocele is the name given to the tumor which forms when a hæmorrhage occurs (*a*) into the sac of the tunica vaginalis (vaginal hæmatocele), or (*b*) into the scrotal tissues around the testicle (extravaginal hæmatocele), or (*c*) with the sheath of the spermatic cord (hæmatocele of the cord).

ETIOLOGY.

A *predisposing cause,* in the shape of disease of the walls of the tunica vaginalis or of the testicle, is very apt to be present.

The *exciting cause* of the hæmorrhage is always traumatism, which may be slight, such as coughing, sneezing, or straining at stool,—or it may be severe and the result of a blow or kick upon the scrotum or the accidental puncture of the testis with a trocar in tapping a hydrocele.

SYMPTOMS AND COURSE.

Swelling of the scrotum takes place very quickly after the injury, and a tumor forms, which is a hard, smooth, globular swelling surrounding the testicle. After a few days inflammatory thickening of the tissues occurs, and the hæmatocele is liable to be mistaken for a neoplasm of the testicle.

The blood-clot may remain for years without being absorbed, in which case the walls of the tunica vaginalis become thick and dense, and the testicle undergoes atrophy. On the other hand, the clot may become infected, and suppuration occurs, ending in abscess.

TREATMENT.

In recent cases a moderate effusion of blood may be absorbed with the assistance of rest in bed, elevation of the scrotum, and 25- to 50-per-cent. ointment of ichthyol; but spontaneous absorption is of seldom occurrence, and operation is usually necessary.

The operative treatment consists in laying open the sac by a free incision and evacuating the blood-clot. The sac of the tunica vaginalis may afterward be treated as a hydrocele, and either exsected or its cavity packed and allowed to granulate.

HÆMATOCELE OF THE SPERMATIC CORD.

This is a rare affection, and may occur from direct violence or from the strain of lifting a heavy weight, even though the cord is perfectly healthy.

A fusiform swelling rapidly develops along the cord, which is easily mistaken for hernia. After a few hours the swelling becomes hard and tense, with ecchymoses into the surrounding tissues, and the diagnosis is made clear.

The treatment is conducted on the same lines as for hæmatocele of the tunica vaginalis.

VARICOCELE.

Varicocele is an abnormal dilatation of the veins of the spermatic cord, and is analogous to the varicosities which occur in the veins of the lower extremities.

A slight varicocele often disappears spontaneously after marriage, when sexual intercourse is duly regulated, and also in old age.

ETIOLOGY.

The causes of varicocele are, in a general way, those of varicosities elsewhere; prolonged standing, ungratified sexual excitement continued for some time, and constipation, all tend to cause passive congestion and disturbance of the circulation, with increase of hydrostatic pressure in the veins of the cord.

The spermatic veins are more liable to enlarge than others, because their valves are insufficient to uphold the long column of blood, which also derive but little external support from the loose cellular tissue of the scrotum in which they lie.

Billroth believes that there is an inherited predisposition to the formation of varicosities, which is first manifested in the spermatic veins, and later in those of the rectum and legs.

Varicocele occurs most frequently on the left side, because, while the right spermatic vein enters the vena cava at a sharp angle, the left spermatic vein, after passing underneath the sigmoid flexure, empties at a *right angle* into the left renal vein. The pressure exerted by the colon and the right-angled insertion of the vein tend to impede the current of blood, and cause an increase in the hydrostatic pressure, which is greater on the left side than on the right.

SYMPTOMS.

In robust and vigorous men varicocele of moderate size causes but little discomfort, at most only a sense of weight and dragging in the spermatic cord, after long standing, walking, riding, or any sudden exertion. These things all exaggerate the swelling of the veins and the discomfort from them is always increased toward evening.

In young men who are weak and anæmic or who have previously masturbated excessively, a feeling of fullness and burning in the scrotum and cord, accompanied by pains radiating into the abdomen and occasionally marked neuralgia of the testicle, is often met with. Such individuals are frequently sexual hypochondriacs, and suffer from mental depression and the fear of impaired virility, or even impotence, arising from the varicocele. They should be taught to regard the varicocele, if moderate in size, with indifference, as it has a natural tendency to subside as age advances and particularly after the regulated coitus of marriage is instituted.

It is only in cases of very pronounced varicocele, where the circulation is materially impaired, that serious atrophy of the testicle occurs, although in every case of varicosities of the cord the circulation in the testicle is somewhat interfered with, and it is softer and smaller than normal.

The spermatic vein may become the seat of disease, and in rare cases thrombosis, phlebitis, gangrene, etc., may occur.

DIAGNOSIS.

The diagnosis of varicocele is usually easy, and the veins in the scrotum feel like a bunch of angle-worms. In very marked cases the enlarged blue veins can be seen shining through the skin of the scrotum. In cases of moderate severity the testicle is slightly flabby and the skin of the scrotum relaxed.

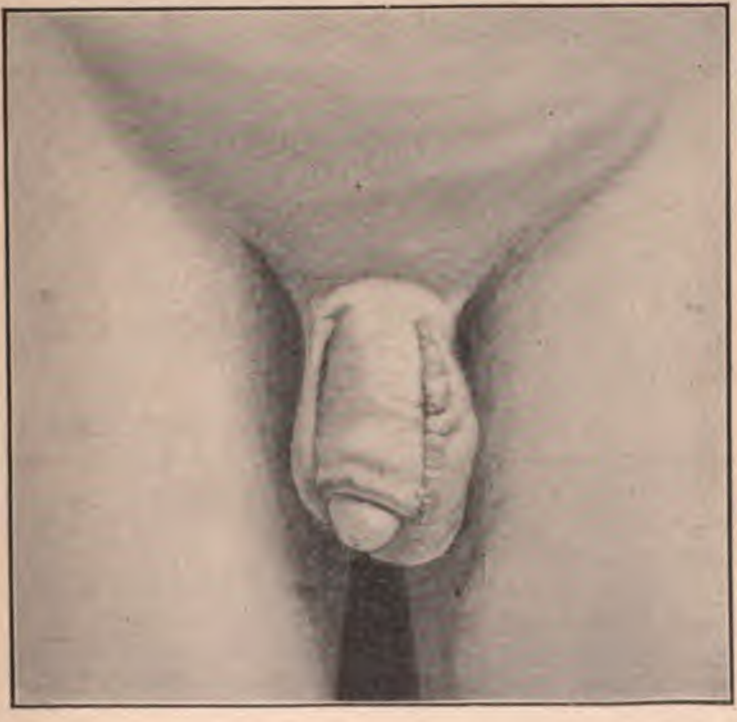

Fig. 137.—Varicocele. (Author's Case, from Kings County Hospital.)

If the patient lies down, the swelling disappears, not suddenly, like a hernia, but more gradually and almost imperceptibly, and, if he stands upright again, pressure with the finger over the external ring does not prevent the veins from refilling with blood, whereas in hernia, the omentum is prevented from descending by pressure over the ring.

TREATMENT.

Palliative treatment is all that is required in varicocele of moderate size and which causes but little discomfort. The scrotum should be supported with a well-fitting suspensory bandage, and locally, cold douching is of service in giving tone to the muscles. Constipation should be prevented, and the patient should avoid erotic excitement or too frequent coitus.

Operation is required only in marked cases, when the support of a suspensory bandage is not sufficient to remove the annoyance of weight and dragging, after walking or long standing, or in cases where a considerable degree of enlargement of the veins exists. Operation is also called for in persons desiring to enter the army, navy, or police service, in which any degree of varicocele is regarded as a disability.

The operation of **subcutaneous ligation of the veins** is popular with some surgeons. It has the advantage that the time of convalescence is a little shortened, but its disadvantages are weighty. A vein is very liable to be punctured, and an hæmatocele occurs. The silk ligature remains permanently, becomes imbedded in scar-tissue, and sometimes causes persistent neuralgia, making it necessary to open up the wound and exsect the knot; or the knot may slip and the vein is not occluded. The danger of tying in the spermatic cord exists, but can be guarded against by due care in holding the cord out of the way.

Relapses occur with greater frequency after subcutaneous ligation than after excision.

Excision of a portion of the veins is the operation to be preferred, and the patient is only kept in bed for a week or ten days. By the open operation it is possible to avoid all the dangers attendant upon the subcutaneous ligation.

Technique.—The patient is etherized, and an incision made over the bunch of veins, beginning near the external inguinal ring and extending two inches down over the scrotum. The veins are exposed by dissection and ligated in two places, about an inch apart. The portion of the veins lying between the ligatures is then cut out with scissors, and the cut ends of each portion of the vein are brought together into apposition and held so, by tying the ends of the ligatures together, and in this way the vein is shortened. The wound is then closed by sutures.

The patient is kept in bed for a week, and on a sofa for another week, and after the third week is completed he can begin his active labors, and the same length of time should elapse after the subcutaneous ligation.

After either operation a hard mass remains in the scrotum, composed of coagula in the veins and infiltration around them. This is absorbed and disappears in from two to four months.

Atrophy of the testicle exceptionally follows either operation, even when the cord is not included in the ligature.

On account of the difficulty of securing a thoroughly sterile operation field, among the rugæ of the scrotum, the following plan for excising a varicocele, by which the incision is made above the pubes, is extensively used in the United States Army and elsewhere.[1]

The pubes are shaved and the skin sterilized in the usual way.

The finger is introduced by the spermatic cord into the inguinal canal until the external ring is felt.

An incision is then made corresponding to the axis of the canal, one inch long, the upper end terminating over the external inguinal ring.

Superficial and deep fascia are divided over a director. The vessels of the cord then come into view. The finger is passed under the cord by a little blunt separation, and the cord is raised out of the wound. The spermatic cord and artery are returned to the bottom of the wound, to prevent accidental injury. A sound vein, selected for preservation to return the blood from the testicle, is carefully separated from the strand of veins and carried alongside the duct.

The veins are then dissected from the connective tissue for a distance of about two inches, ligated with small-sized catgut at the end of these dissections, and cut off between the ligatures.

The ends of the ligatures are then tied together, thus approximating the upper and lower ends of the veins. For further safety the ends are united by stitches, and finally anchored to the external pillars of the ring.

The deep and superficial fascia are then separately united with a continuous catgut suture, and the skin by a subcuticular suture of silkworm gut.

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[1] Circular No. 3, from Surgeon General's office, February 27, 1901.

This method has been found very successful in preventing infection of the wound, either during the operation or subsequently.

DIAGNOSIS OF TUMORS IN THE SCROTUM.

Ordinarily the diagnosis of the nature of a tumor in the scrotum can be made without much difficulty. In a few cases, however, it is impossible to make a diagnosis until the scrotum is freely incised and laid open, and the tumor is fully exposed to view.

A methodic examination will facilitate arriving at a correct opinion, and the student may find the following schematic arrangement of use.

We should endeavor to determine if the tumor in the scrotum is an

Enlargement of (a) the testis or (b) the epididymis.

Hernia.

Hæmatocele.

Varicocele.

Hydrocele (a) of the tunica vaginalis; (b) of the spermatic cord.

History.—Age of patient and general condition; family history of tuberculosis; any previous manifestations of tuberculosis in lungs, bones, joints, or genito-urinary tract.

Length of time growth has existed, and if it grew slowly or came on suddenly, and if reducible.

Inquire as to pain, traumatism, gonorrhœa, and syphilis. If treatment has been previously used, note the effects of tapping and inunctions of mercury and iodide of potash in large doses.

Examination.—*Palpation.*—Observe if the body of the testicle is involved, or the epididymis; also the size, shape, and density of the tumor, particularly with reference to fluctuation, elasticity, or stony hardness. Note if the spermatic cord is enlarged or not, and if the tumor is reducible; if the inguinal ring is open and enlarged, and if an impulse is felt on coughing.

The condition of the scrotal veins should be examined with the patient standing upright, for a varicocele always disappears when the individual lies down.

The sign of **translucency** is obtained by examining the tumor with transmitted light.

In the presence of a solid tumor or hernia, the light is obscured; but in a simple hydrocele, with clear contents and thin walls, the light passes through. If the walls of the sac are thickened, or if it is filled with blood or chylous contents from lymph, and in the tropics, filaria, the light is not transmitted, and the hydrocele appears opaque.

Puncture of the tumor with an aspirating needle never does harm, and often may clear up the diagnosis by demonstrating the presence and character of the fluid withdrawn, or the fact of its absence.

When, in spite of the methodic examination, doubt exists in the surgeon's mind as to the nature of the growth, the patient should be prepared for operation, etherized, and a free incision made over the tumor, which can then be dealt with as occasion requires.

CHANCROID AND ITS COMPLICATIONS.

CHAPTER XIX

CHANCROID.

Synonyms.—Soft chancre, or simple venereal ulcer.

The etiology of chancroid was, until very recently, involved in obscurity. There were two views held as to its exciting cause.

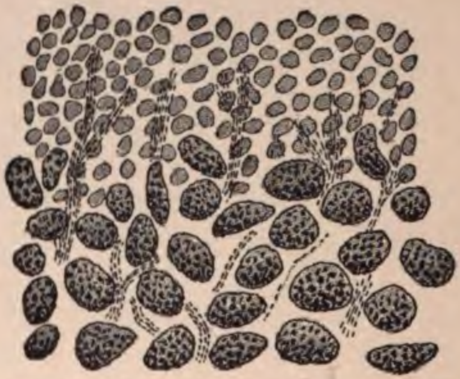

Fig. 138.—Section of Chancroid, showing Ducrey's Bacillus, which has the form of small rods arranged in chains.

One opinion (*a*) as to the causation of chancroid, which was generally accepted, was that chancroid is merely an active form of wound-infection and that it is caused by the inoculation under the skin of any of the pus-producing micro-organisms, and in this and other respects, resembles, clinically, impetigo contagiosa or ecthyma.

The other view (*b*) is that chancroid is due to a particular micro-organism produced in another chancroid, and called, after its discoverer, the **Bacillus of Ducrey.** This was not universally accepted at first, but the experiments of Bezancon, Griffon, Le Laurd, and Lenglet, in making cultures and inoculations, have, within the past year decided the question definitely, and today Ducrey's bacillus is accepted as the pathognomonic organism of chancroid.

The experiments above mentioned were confirmed by Tomaszewski,[1] who inoculated two apes with chancroidal virus. These were followed by sores from which he made pure cultures, inoculated himself and recovered the bacillus of Ducrey.

MODES OF CONTAGION.

(*a*) *Immediate: i.e.,* through direct contact, as in coitus, or by digital examination, etc.

(*b*) *Mediate,* in which contact is not made with the chancroid, but some of the pus is deposited upon an instrument, towel, chamber utensil, water-closet seat, etc., and from this point is brought into contact with another person, who becomes infected.

The pus from a chancroid is acrid and irritating, and has the property of softening and corroding the healthy epidermis; so that an *abraded surface is not essential* for the entrance of the microorganisms under the skin.

The theory of *indirect contagion* is not universally accepted, for some authorities claim that the chancroidal virus cannot penetrate the epithelium, and either a small open wound must be present or the pus may be introduced under the skin through a follicle.

FREQUENCY OF CHANCROID.

Chancroid is more common among the lower classes than among cleanly and well-nourished people, as its development is favored by filthy habits and dirty surroundings, and all the accompaniments of privation and misery.

COURSE.

Chancroid is usually multiple, although it sometimes exists singly. The fact of the sores being multiple is accounted for in the following ways:—

(*a*) A number of points are inoculated with chancroidal pus at the time of contagion.

(*b*) Through *autoinoculation.*

Autoinoculation may be defined as the action of pus formed in one chancroid producing other chancroids in the same individual: *i.e.*, the inoculation of the patient with pus from his own chancroid.

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[1] Archiv für Bacteriologie, 1904.

After inoculation, in about twenty-four hours several *pustules* appear, which spread at the margins; the tissues adjacent are involved and break down, and the ulceration extends.

CHARACTERISTICS.

In chancroid there is no period of incubation, and it is generally noticed on the third day after coitus.

The location is usually on the genitals, although it exceptionally occurs on the fingers.

In **shape** the sore is usually irregular from the confluence of several sores, although it may be round or oval.

Number.—It is exceptional for chancroids to exist singly. They are usually *multiple*, either from the simultaneous inoculation of several points at first or from subsequent autoinoculation.

Pain is usually present to a considerable extent.

The base of the sore in a typical case is *devoid of induration*, but if an excessive amount of inflammation has taken place—as a result of insufficient and frequent cauterization, prolonged contact with irritating urine, pus, or acrid secretions—an inflammatory or boggy hardness is often present. This does not feel like the induration of a chancre, which is sharply defined and which resembles a piece of cartilage under the skin, but is doughy or boggy in feeling, and shades off gradually into the surrounding tissues.

Chancroids located in the sulcus coronarius, from the amount of induration which always accompanies them, may be easily mistaken for the initial lesion of syphilis.

The floor of the chancroid is rough and uneven, and covered with a dirty-grayish deposit.

The edges of the sore are undermined; the *discharge* is abundant, purulent, and sometimes bloody.

Duration of the chancroid may be divided into stages:—

I. Progressive stage, during which each sore extends by a breaking down and ulceration of the edges, and fresh sores are continually forming as a result of autoinoculation.

II. Stationary stage. After a time the pus loses its virulence, autoinoculation of fresh surfaces no longer occurs, and the ulcers cease to increase in size, but remain stationary.

III. The reparative stage begins when the sores are covered with healthy granulations and cicatrization is in progress.

The various stages require about six weeks in time for uncomplicated cases, but **relapses from autoinoculation** are very frequent, and delay the healing process.

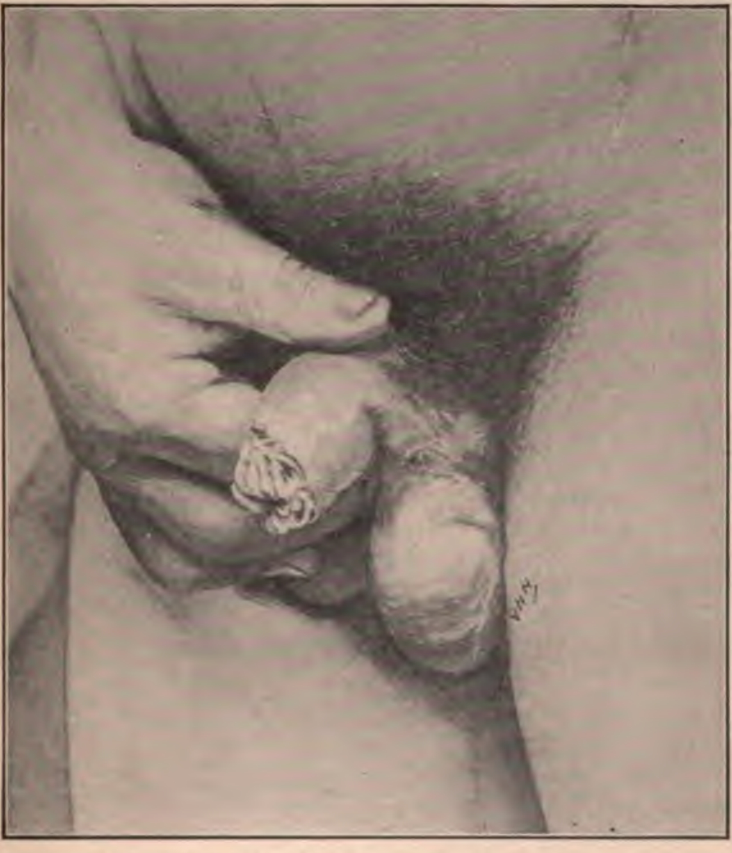


Fig. 139.—Chancroids of the Prepuce. (Author's case, from Kings County Hospital.)

Microscopic examination of a chancroid shows it to be composed of a small round-celled infiltration which takes place in the skin and subcutaneous tissues, and which leads in time to coagulation-necrosis.

The lymphatics are not involved, but remain open and gaping, ready to convey micro-organisms or toxins to the nearest lymphatic gland, and in this way we can account for the frequent occurrence of bubo.

Until 1852 chancroid was regarded as a syphilitic manifestation; yet the true difference between the two diseases would have been sooner discovered but for the **mixed sore.** It sometimes happens that an individual is syphilitic and has accidentally acquired chancroids.

As a result of contact with both poisons, usually during coitus, another person receives a *double infection: i.e.*, the virus of syphilis and that of chancroid are both inoculated at the same moment. The chancroid appears in twenty-four hours, but on account of the longer incubation of syphilis, the chancre is not evident for at least three weeks. After this period has gone by, the base of the chancroid becomes hard and sclerosed and the sore is transformed into a true chancre which is followed by symptoms of constitutional syphilis.

DIAGNOSIS.

It is often difficult to make a differential diagnosis between chancre and chancroid, particularly in the cases where an excessive amount of inflammation has occurred and a condition of boggy inflammatory induration is present. We should always bear in mind the possibility of a mixed sore being present, and it is usually well to allow three or four weeks to elapse before excluding syphilitic infection.

The principal points to consider in making a differential diagnosis are as follows:—

I. The period of incubation: *i.e.*, the time which elapses between coitus and the appearance of the sore.

II. The *absence* of the cartilaginous induration, which characterizes the primary lesion of syphilis.

III. The ragged, punched-out appearance of the sores, which are usually multiple.

IV. The character of the accompanying enlargement of the inguinal lymphatic glands.

Syphilitic glands are always arranged in a chain resembling a rosary, while the enlarged glands accompanying chancroid are in the form of a packet, on account of the periadenitis, which is always lacking in syphilis.

Herpes præputialis is sometimes incorrectly diagnosed as chancroid. This mistake ought not to occur, if due care is used in the examination. Herpes appears as a number of small vesicles, which form upon the glans, prepuce or skin of the penis. The vesicles soon break, and leave small, round, superficial erosions, which rapidly heal under a simple dusting-powder.

TREATMENT.

(a) Abortive.—If the chancroid is seen early enough, the indication for treatment is to *destroy* the chancroidal character of the sore and transform it into a simple non-infected ulcer.

Methods.—Nitrate of silver should never be used for this purpose, as its cauterizing action does not penetrate deeply enough into the substance of the sore.

The best means of destroying a chancroid is by the Holländer hot air apparatus, followed by scraping it with a sharp curette. Holländer's apparatus is a combination of a Paquelin cautery and an air pump. The air is heated to a temperature of 400° F. and acts as a caustic, but has a selective action and destroys only the diseased portions of the tissues. This is followed at once by curettage with a sharp spoon.

This method is also useful in making a differential diagnosis between chancroid and chancre. The chancroid can be entirely scraped away, but a chancre is so tough that it cannot be removed by curetting.

Before using the apparatus, ethyl chloride may be sprayed on the wound, or cocaine injected hypodermically for the pain.

Fuming nitric acid or the acid nitrate of mercury upon a glass rod, applied to the sore, will answer the same purpose of cauterization. The ulcerating surfaces should be washed clean and anæsthetized by chloride of ethyl, a drop of carbolic acid or cocaine solution before cauterizing.

It is an error to cauterize every chancroid as a routine measure, and we can lay it down as a rule *never* to cauterize *unless the chancroid is free from complications*, as follows:—

Contra-indications for Cauterization.—(*a*) If the inflammation is already excessive and much *inflammatory œdema* is present, the irritation of cauterizing will increase it.

(*b*) If *inguinal adenitis* is present, the bubo will be made worse by cauterizing the chancroid.

(*c*) In the case of a *healing cicatrizing chancroid* the chancroidal virus has already disappeared, and cauterization is useless.

(*d*) If a *number* of *chancroids* are *present*, and *only a few are exposed*, the entire number should be destroyed, or none at all, for if any are left untouched, they will secrete pus, which will infect fresh surfaces.

(*e*) If a chancroid of the meatus or in the urethra is cauterized, the resulting cicatricial contraction after the sore is healed will produce too much deformity of the parts affected.

(b) The methodic treatment is carried out by means of:—

I. Cleanliness.

II. Antisepsis.

III. Rest.

The chancroids should be kept free from the accumulation of discharge by means of frequent washing with solutions of bichloride of mercury, 1 in 10,000 to 1 in 5000; or carbolic acid 2 per cent.

Dry dressings or dusting-powders should only be used under the foreskin and never upon a sore located on the integument. The powder, which is exposed to the air, dries, sticks fast, and forms a scab or crust which prevents the discharge from escaping, and the ulceration extends unnoticed under the dried powder. Whenever the dressing is changed the dried powder adheres to the sore, and on being pulled away forcibly, tears open the wound, affording fresh points for inoculation or destroying the newly-formed epithelium at the cicatrizing edge of the wound.

The following antiseptic powders are the most serviceable: Iodoform, salicylic acid packed into the sore, aristol, subgallate of bismuth (dermatol), resorcin, nosophen, and europhen.

An objection to iodoform is its odor, but in many cases of chancroid where inflammation is active and the ulceration is extending, iodoform is the only remedy which acts as a specific and checks the tendency to destruction.

The odor of iodoform can be effectually disguised by using a 10-per-cent solution in ether to which a few crystals of cumerine have been added (about gr. ij to the ounce).

The solution is applied to the surface of the chancroid with a medicine-dropper and is quite as active when used in this way as in powder.

Olei lignii sassafras, 2 drops to 10 grains, is also used to disguise the odor.

The penetrating odor of iodoform may often debar its use in private practice, and perhaps the best antiseptic powder to use in its place is europhen, which, however, is not as effective as iodoform.

The use of *hot water,* preferably in the form of a sitz bath for an hour at a time several times a day, is a valuable adjuvant in improving the circulation, lessening the inflammation, and bringing about a reparative action.

When a healthy, granulating surface of the ulcer announces the beginning of the stage of repair it is desirable to discontinue the iodoform, which is only useful as an antiseptic, and dress the ulcer with a mild stimulant like balsam Peru. Or:—

℞ **Zinci Sulphatis**	gr. viij.
Spts. lavend. comp	℥ij.
Aquæ	℥iv.

At this time benefit is also derived by touching lightly the granulating surfaces with nitrate-of-silver solution (gr. xx to ℥j) every few days.

When the chancroid is located **upon the integument** *wet dressings* are called for. The sore should be dusted with iodoform or europhen and covered with a piece of gauze wet with bichloride solution or liquor ammonii acetatis.

A piece of gutta percha tissue, to prevent evaporation, should be laid over the gauze and held in place with a bandage.

When the granulations become sluggish, a favorite application in Lesser's clinic is camphor wine or aqua chlori. A bandage is wet in the solution and changed every fifteen minutes.

In the so-called *ulcus elevatum,* in which the granulations have grown up above the level of the skin, it is good practice to cut them off with a razor, apply the Paquelin cautery afterwards, and dress with iodoform and a wet dressing.

A *mixed infection with gonococci* sometimes occurs, especially in women.

This condition may be well treated by using protargol solution, 1 per cent., as an irrigation, followed by brushing with 10 per cent. nitrate of silver as a caustic, and dressing with bandages wet with 5 or 10 per cent. protargol solution.

COMPLICATIONS OF CHANCROID.

The accompanying inflammation may at times become *excessive* from such *general* causes as debility or some dyscrasia, or *local* causes, such as a contact of urine or lack of cleanliness. An excessive inflammation, if untreated, is apt to terminate in *gangrene* and sloughing of the parts.

Subpreputial Chancroids Complicated by Phimosis.—When chancroids are located under a long and tight foreskin, the resultant swelling and œdema prevent its retraction, and render the diagnosis difficult. Artificial inoculation of the patient upon the thigh, with pus from under the foreskin, has been resorted to, to differentiate between chancre and chancroid.

The possibility of the presence of a mixed sore should always be borne in mind in these cases.

TREATMENT.

The preputial sac may be kept clean by the use of antiseptic injections with a flat-billed syringe under the foreskin, using liquor ammonii acetatis, or sublimate solution, every hour or two, and the penis should be soaked in hot water. An attempt should also be made to retract the foreskin.

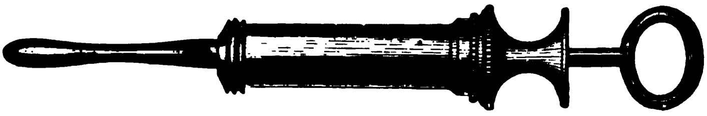


Fig. 140.—Taylor's flat-billed Syringe for washing out the Balano-preputial Sac.

On account of the danger of paraphimosis, the foreskin should not be left retracted, but drawn back into place.

In case the swelling increases and surgical interference is not resorted to, the dorsum of the prepuce becomes gangrenous and sloughs in part, or the entire foreskin sloughs off (spontaneous circumcision), or the glans penis becomes gangrenous and sloughs, either entirely or partially.

If gangrene is threatening, recourse must be had at once to operative measures. The prepuce should be slit up, upon the dorsum, with a curved bistoury, to relieve the tension.

After exposing the chancroids, in most cases it is better not to use any cauterizing agents upon the sores or on the fresh cut surface of the prepuce, as an intense reaction always follows cauterization, which delays the convalescence.

With the above treatment there is very little reaction and the wound is healed and ready for circumcision in fourteen days.

Circumcision should never be performed *in the presence of chancroids* on account of the danger of infecting the wound with chancroidal virus, and converting its entire surface into a chancroidal ulcer.

In all cases of subpreputial chancroids, if at all severe, the radical treatment of slitting up the foreskin and cauterizing is to be preferred to temporizing with injections under the foreskin.

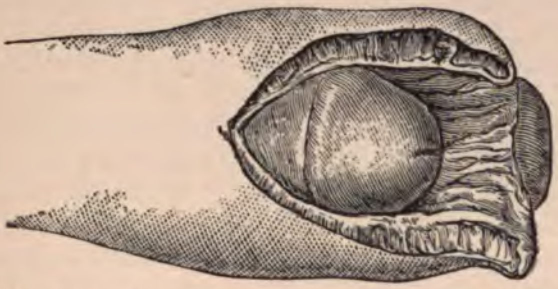


Fig. 141.—Dorsal Incision through Prepuce to expose Chancroids.

When *chancroid* of *the frænum* exists, the artery is liable to be ruptured during erection and hæmorrhage occurs. To prevent this accident, it is proper to tie a double ligature around the frænum, divide the frænum between the ligatures with a pair of scissors, and cauterize the sore.

Paraphimosis is the condition in which a long foreskin is retracted behind the glans, and, from the swelling and œdema which take place in it, is prevented from being drawn back into place. Gangrene and sloughing may result, if the condition is left untreated. The constricting band should be cut upon the dorsum by inserting a curved bistoury under it and cutting outward.

PHAGEDÆNA.

This, the most formidable of all the complications of chancroid, is rarely encountered at the present day.

It is due to debility of the individual attacked, as a result of some dyscrasia, alcoholism, syphilis, tuberculosis, privation, etc., together with an exceptional virulence on the part of the invading organisms.

Three varieties are noted:—

(a) Gangrenous.—The tissues die *en masse.* Probably due to a mixed infection with streptococcus and Ducrey's bacillus.

(b) Serpiginous.—Caused by Ducrey's bacillus (Rona), perhaps also from gonococci (Thelman).

(c) Phagedænic.—Does not penetrate so deeply, attacking only the skin; more chronic in its course and *perhaps* an autoinfection, caused by Ducrey's bacillus and fusiform bacilli (Rona, Matzenauer), resembling the organism of Vincent's angina.

The etiology of gangrenous, serpiginous, and phagedænic chancroids is not fully understood. It is supposed that they are due to some dyscrasia from excesses, poverty or alcohol, and that the *exciting cause* is probably a mixed infection with Ducrey's bacillus and streptococcus. In a few cases gonococci have been found. Another view is that the varieties are a form of hospital gangrene of the wounds. In many cases neglect of the chancroidal wound and uncleanliness are responsible for the occurrence of this complication. It occurs at times in strong, hearty individuals, and in these cases the cause is entirely unknown.

In the serpiginous form the infective principle remains active for years.

DIAGNOSIS.

It is always difficult to differentiate these conditions from syphilitic manifestations. The best method of making the diagnosis is by watching the effects of a vigorous course of antisyphilitic treatment.

TREATMENT.

The first indication is to treat the dyscrasia, by means of tonics, of which the potassio-tartrate of iron in 5-grain doses every three hours is highly spoken of, quinine in tonic doses, and opium for its effect on the pain. Easily-digested nutritious food and milk-punch should be administered.

In phagedæna, either sloughing or serpiginous, *hot baths* are especially valuable. The patient should spend as much time as possible sitting in a tub of hot water which is maintained at a high temperature.

Under the use of the hot water the sloughing often ceases, and the ulcers take on healthy granulations.

In sloughing phagedænic chancroids, after necrosis has occurred, the separation of the sloughing areas is facilitated by the application of hot fomentations.

Iodoform gauze soaked in wine of camphor is a favorite application in Lesser's clinic. The sloughing variety of phagedæna should always be treated very conservatively, and curetting or cauterizing the wound is entirely inadmissible.

In the *serpiginous* form, which is extending, active radical treatment is demanded; the diseased area must be completely destroyed by curetting with a sharp spoon, followed by cauterization with the Paquelin or nitric acid and subsequently the free use of an iodoform dressing. Absolute rest in bed is, of course, imperative.

BUBO.

The term bubo is applied to the inflammatory enlargement of any lymphatic gland, but especially in the inguinal region.

It accompanies chancroid in from 30 to 50 per cent. of all cases, and it is particularly liable to occur in debilitated, badly-nourished subjects.

ETIOLOGY.

It was formerly not known whether the inflammation of the lymphatic glands was caused by the micro-organisms formed in the chancroid and carried through the lymphatic vessels, or whether it was due to a deposit of toxins in the glands.

It is now known that buboes are caused not by the toxins, but by the presence of Ducrey's bacillus in the glands themselves. Buboes have been incised, their walls scraped with a sharp spoon, and Ducrey's bacillus found. After twenty-four hours, mixed infection occurs and the streptococcus can be identified.

COURSE.

One gland alone may be infected, but, as a rule, the whole chain on one side is involved, and it is not infrequent for several glands on both sides to be attacked.

The chancroid may be located on the right side, while the bubo occurs on the left side, or *vice versa,* and it occurs most frequently when the sore is located on the frænum or sulcus coronarius.

Exceptionally the involvement of the glands may disappear by resolution, but in the great majority of cases the glands suppurate and break down. The suppuration and softening of the whole gland may run a comparatively rapid course, but, on the other hand, the process of softening of the chain of glands, their breaking down and suppuration, the slow evacuation of the pus through a small opening, may be a very protracted one, and may last for months unless the diseased glands are completely extirpated by surgical measures.

In cachetic individuals, buboes run a very chronic course, and often break down and ulcerate slowly.

Bubo occurs less frequently in women than in men, because women's occupations do not require so much bodily activity.

A common cause of bubo is the frequent cauterization of a chancroid with nitrate of silver. This causes a crust to form over the sore, and the organisms cannot escape from the wound; they make their way into the lymphatic glands, and swelling and suppuration are more apt to occur.

After a bubo breaks down and discharges, the wound may become converted into a chancroidal ulceration, either serpiginous or sloughing.

If sepsis occurs, it is due not to Ducrey's bacillus, but to a mixed infection with streptococci.

Lymphangitis, or a swelling and inflammation of the lymphatic vessels, frequently occurs as a complication of bubo.

Bubo d'Embleé is a term frequently used in France, and is applied to the cases when a bubo occurs without a history of a sore.

It is always caused, however, by a previous sore, which may have healed at the time the bubo first appears.

In making the diagnosis of bubo, the possibilities of cryptochism, or hernia, or enlargement of the inguinal glands, from tuberculosis or carcinoma, should be borne in mind.

The accompanying table indicates the chief points of difference between the glandular enlargement of syphilis and that of chancroid:—

DIFFERENTIAL DIAGNOSIS OF BUBO AND SYPHILITIC ADENOPATHY.

CHANCROID.	SYPHILIS.
One side affected, as a rule.	Both sides affected.
Shape:	*Shape:*
Irregular and boggy.	Regular, smooth, and hard.
Size:	*Size:*
Large.	Small.
Number:	*Number:*
May be single.	Always multiple and arranged in a chain.
General Characteristics:	*General Characteristics:*
Considerable amount of inflammation, causing adherence to overlying skin. Generally suppurate.	No inflammation. Not adherent to skin, but freely movable. Do not suppurate.
Packet form.	Rosary form.

TREATMENT.

The indications are:—

I. To prevent suppuration.

II. After suppuration has taken place, to evacuate the pus and extirpate the diseased glandular structures.

I. To prevent suppuration, the most important measure is ***rest in bed,*** supplemented by the pressure of a sand-bag over the inflamed gland, together with warm applications.

The ice-bag is no longer used, because it has been found that warm applications cause resolution just as well.

Gauze wet with warm liquor ammonii acetatis, applied over the gland, and a sand-bag above it, is a suitable dressing.

A favorite method of treating buboes before suppuration, in Lesser's clinic, consists in wearing gauze wet with 95 per cent. alcohol, next the bubo, covered with non-absorbent cotton and gutta percha tissue, with holes cut in it, over all. Alcohol is poured on the dressing twice a day, to make up for the loss by evaporation.

Tincture of iodine painted around the gland, or the following salve rubbed in, is also used in some ambulatory clinics.

℞ Tinct. iodine	2 parts
Potass. iodine	3 parts
Lanolini	20 parts

Sig.: External use.

Treatment after suppuration.—When fluctuation is noted, the suppuration should be hastened by hot applications, instead of warm.

The thermaphore is very useful in keeping the applications hot in these cases. The hot applications are continued until the gland has fully broken down, and when it is soft all over, and full of pus, a small incision with a double-edged knife should be made, and the pus evacuated. Iodoform glycerine, 10 per cent., is then injected into the cavity. The emulsion should be injected three times at the first sitting. The first two injections run out, and the last one remains in.

The wound is then bandaged with gauze, moistened with liquor ammonii. On the following day the wound is emptied by squeezing, and iodoform emulsion injected three times again, the last injection being left in. The bandage is then applied, and in five or six days the wound is closed and healed. If after a week the wound is not closed, it should be injected again, and in five or six days the wound has usually healed, and the bubo disappeared.

The method of injecting the wound with silver nitrate is abandoned, on account of the pain which is caused, and because it is no better than the injection with iodoform.

The plan of encouraging suppuration and evacuating the pus through a small incision is satisfactory in most cases when the glands break down rapidly, but sometimes the suppuration goes on very slowly, and it is better to make a free incision, evacuate the pus, dissect or curette out the partially broken-down remains of the glands, pack the wound with gauze, and allow it to heal by granulations.

It is better to avoid this if possible, as the subsequent healing takes six or eight weeks, and requires daily dressings.

It was the practice a few years ago to endeavor to prevent suppuration in the glands by making a curved incision over them, dissecting them out, and closing the wound by suture.

This practice has now been abandoned, because it was found that a permanent œdema, resembling elephantiasis of the penis and scrotum, and inguinal region, followed in consequence of the obliteration of the lymphatic vessels in the process of wound healing.

Another objection was that when patients came to operation, suppuration had nearly always begun in the center of the gland, even though no fluctuation was evident; the wound was not aseptic, and could not be closed, but had to be left open, for the slow process of healing by granulation.

In cases when a bubo has broken down, become infected with chancroidal virus, and converted into a **serpiginous ulceration,** the following treatment is a favorite one at the Charitè, in Berlin.

It is also useful in old, indolent chancroids, or any chronic ulcerative process.

Technique.—The edges and surface of the wound are scraped with a sharp spoon, and afterwards seared superficially with the Paquelin. The surface is then brushed over with 10 per cent. zinc chloride solution, and a bandage of iodoform gauze, wet with wine of camphor, applied.

As soon as granulations are on a level with the skin, and very little pus is present in the wound, it should be dressed with a nitrate of silver salve.

℞ Silver nitrate	2
Balsam Peru	20
Vaseline	q. s. ad 100

Under this treatment these ulcerations heal satisfactorily.

SYPHILIS AND ITS LESIONS

CHAPTER XX.

CHANCRE.

Synonyms.—Initial lesion of syphilis; initial sclerosis; hard chancre.

Definition.—Chancre may be defined as "the first manifestation of the syphilitic poison at the seat of its entrance into the body."

The poison of syphilis, which is inoculated into an individual and causes the chancre, is derived from the secretions and broken-down *detritus* formed in:—

(*a*) A chancre in another person.

(*b*) Mucous patches.

(*c*) Condylomata.

(*d*) Blood.

(*e*) Lymph.

(*f*) It was formerly thought that the *physiological secretions* did not contain the syphilitic virus, but recent investigations have shown that in exceptional cases they do contain the poison.

COURSE.

When the poison of syphilis is first inoculated under the skin, it is too small in quantity to produce any symptoms. But the poison increases in amount, and, after three or four weeks have passed, the quantity is so great at the point of inoculation that the tissues react, and the chancre appears.

At this time the syphilitic virus is not distributed all through the body, but is localized to the tissues around the chancre and in the nearest lymphatic glands. Later on in the disease, the poison increases to an enormous extent, makes its way through the lymphatic system into the circulation, and the blood and lymph become surcharged with it.

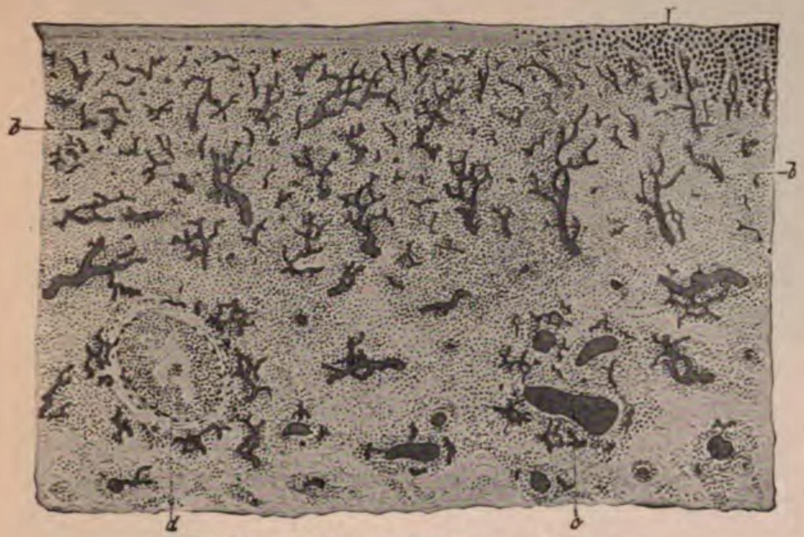


Fig. 142.—Section of a Chancre (Injected).

a, Rete mucosum.
b, Small round-celled infiltration with numerous injected blood-vessels.
c, Blood-vessels with endo- and peri- arteritis.
d, Lymphatics with adventitial and endovascular changes.

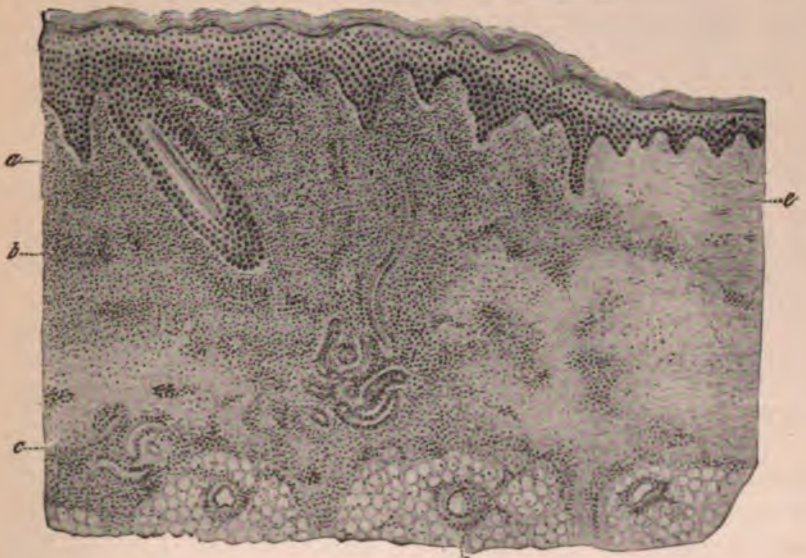


Fig. 143.—Section through a Papular Syphilide.

a, *b*, *c*, Small round-celled infiltration through corium and rete mucosum and around hair-follicles and sweat-gland.
d, Blood-vessels, with infiltration of the adventitia.
e, Normal cutis.

(From "Die Syphilis und die Venerischen Krankheiten," von Dr. Ernest Finger.)

The pus from a chancre, unlike that formed in a chancroid, has not the property of destroying the epidermis, and in order to produce a chancre it is necessary that the poison from a syphilitic lesion be introduced through an *abraded surface.*

This fact explains the cases in which a physician attends a syphilitic woman in confinement or a man has coitus with a woman who is affected with condylomata or a chancre, and if an abrasion did not exist at the time of contact, inoculation does not occur.

Every case of syphilis contracted after birth must have a chancre for its point of departure.

There is, however, one *exception* to this rule. A healthy woman who has connection with a syphilitic man may escape inoculation with syphilis, but become pregnant. The child which is generated by a syphilitic father is infected with syphilis, and as it develops *in utero* the syphilitic virus passes from the child to the mother through the placental circulation, and in turn the mother becomes infected with syphilis from her own child. In this case chancre does not form either in the mother or child.

The form of infection of the mother just described, from carrying her own child *in utero,* is called "*Choc en retour,*" or "syphilis by conception."

TRANSMISSION OF CONTAGION.

The methods by which the contagion is transmitted may be classified as:—

(*a*) Direct.
(*b*) Indirect, or mediate.
(*c*) Inheritance.
(*d*) *Choc en retour,* or syphilis by conception.

By *direct contagion* we understand those methods in which the syphilis is inoculated by *personal contact,* such as coitus, kissing, surgical operations, a syphilitic child infecting its wet-nurse, or a healthy child acquiring syphilis by nursing from a syphilitic wet-nurse.

In *indirect* or *mediate contagion,* the disease is conveyed through the medium of some article which has been infected with the virus of syphilis, such as a spoon, pipe, cup, or cigar used by a person with mucous patches in the mouth; an instrument used for tattooing, dental, or surgical operations, which has been used on a syphilitic individual and was not cleaned afterward, the tubes used in common by glass-blowers, or by means of underclothing or a bathing-suit which was stained with secretions from syphilitic lesions.

Vaccination chancre in former years was not uncommon, and was caused by vaccinating with an instrument which had previously been used to vaccinate a syphilitic individual, and which was not afterward cleansed, but was used still contaminated with the syphilitic virus.

Chancres were also produced by vaccinating with dried lymph-crusts, which had been taken from vaccine-vessels produced in an individual who was also affected with syphilis at the same time.

At the present day animal-vaccine lymph, taken from the calf, is used exclusively, and as cattle are immune from syphilis, a chancre as the result of vaccination never occurs.

The **location of the chancre** depends, of course, upon the point at which the syphilitic virus is inoculated. The chancre appears most frequently on the genitals, but may be on the lips, tongue, breast, or fingers. It begins as a papule or small tumor, which increases in size; the surface becomes eroded, or ulcerated, and furnishes a secretion which is not autoinoculable. The most characteristic feature of the chancre is **induration of the base,** which is caused by a deposit of small round cells in the tissues underlying the chancre, and also by inflammatory changes in the blood-vessels and lymphatics.

PATHOLOGY.

On microscopic examination of a section from a chancre, the findings are as follows:—

I. A small round-celled infiltration of the skin and subcutaneous tissues such as occurs in every inflammation. The latest investigation of the pathology of chancre shows that the *lymph vessels* are primarily affected with an inflammation of their inner coats. The affection is particularly marked in the lymph vessels which accompany the vasa vasorum. The *media* of the arteries are secondarily attacked and finally *endarteritis* occurs.

The changes in the arteries are more apparent than those in the lymphatics, and for that reason the alterations in the lymphatics were overlooked by the earlier observers.

II. Changes in the Blood-vessels.—The veins and arteries are both affected by the endarteritis, but the changes are more marked in the arteries. The endothelial cells of their inner coats are swollen and the lumen of the vessel is diminished. The middle coat is usually slightly thickened and infiltrated, but the important change is in the *outer coat,* which is the seat of an infiltration with small round cells.

In consequence of all the changes described, the circulation of blood is shut off, and coagulation-necrosis, with sloughing of small areas of tissue supplied by the affected vessels, takes place.

It is desirable to understand clearly the pathological changes, since all syphilitic lesions—including chancre, papule, and gumma—are identical, and are due *primarily* to endarteritis, and *secondarily* to the accompanying round-celled infiltration.

In rare instances an *endo-lymphangitis* occurs, which obstructs the flow of lymph, and occasions a hard, boggy condition of the tissues, causing the so-called *indurative* or *sclerotic œdema.*

The **hardness** and **sclerosis** of chancre are not entirely accounted for by the microscopic findings, because the infiltrating cells are present in spots where no trace of hardness is perceptible to the touch.

Unna attempts to account for the hardness by supposing that a deposit of colloid material takes place around and between the bands of round-celled infiltration in the older parts, but that it is not formed as rapidly as the infiltration advances at the periphery.

The essential characteristics are always the same, but chancres vary considerably in outward appearance, as, for example:—

(*a*) In the amount of induration.

(*b*) In the depth of ulceration.

(*c*) In the amount of inflammation of the surrounding tissues.

Therefore chancre is grouped in several varieties.

The form of the chancre differs, depending upon the anatomical part upon which it is located, and also upon the course and situation of the blood-vessels.

When they run horizontally and near the surface, a thin, flat layer of infiltration occurs under the skin, which is called **parchment induration.** On the other hand, when the blood-vessels dip down deeply into the tissues, the induration is extensive and deep, and is called **Hunterian induration.**

For example: inside the prepuce, the parchment chancre often occurs; in the sulcus coronarius, a heavy mass of infiltration takes place, forming a Hunterian chancre; on the frænulum, a thick string occurs; and on the glans, a flat erosion.

VARIETIES.

I. *Dry papule,* which is made up of a very slight amount of induration.

II. *Hunterian chancre.* In this variety, which is named after John Hunter, a considerable amount of induration is present. Its central part is the seat of a coagulation-necrosis, from the endarteritis which occludes the blood-vessels and causes a depression in the centre, which is funnel-shaped, or like the crater of a volcano. The Hunterian chancre is the form most commonly met with.

III. *Parchment chancre.* This form is due to a superficial layer of infiltration lying immediately under the skin and widely spread out in the tissues. It feels like a piece of parchment on being pinched up between the fingers.

IV. *Indurative or sclerotic œdema.* This condition is produced by a combination of the usual endarteritis and small round-celled infiltration. It is accompanied by an inflammation of the lymphatic vessels or endo-lymphangitis, and usually occurs on the female genitals.

The circulation of the lymph is interfered with, and it transudes from the lymphatic vessels into the tissues. This combination of pathological changes gives rise to a boggy condition of the tissues, which is harder and more pronounced than in simple œdema, and, on being pinched between a finger and thumb, a condition of *fibrosis* is felt. Indurative œdema is a rare condition, but occurs more frequently on the female genitals than in men.

CHANCRE HEALS WITHOUT LEAVING A SCAR.

The ulceration and necrosis of the chancre take place at the expense of the newly-formed tissue-elements, rather than the normal structures of the parts affected, and consequently no scar results. Chancroids always leave a scar after healing, because the ulceration spreads and destroys normal fixed cells of the part.

DURATION OF THE CHANCRE.

A chancre may heal in a few days or may remain unhealed for many months, especially if it is located under the prepuce and provided no mercurial treatment is given.

CHANCRE OF THE URETHRA.

Chancre situated *within* the urethra is a rare condition, but it does occur at times. It is usually located from one-half to one inch from the meatus, and the only symptom which it occasions is a thin discharge from the urethra, which may be easily mistaken for a gonorrhœa. Examination, however, shows a hard, sclerotic mass surrounding the urethra under the skin, and the nearest lymphatic glands are also enlarged.

A knowledge of the fact that a chancre may be concealed within the urethra will sometimes be of service in explaining the cases of syphilis in which the patient admits having had a slight gonorrhœa, but who denies that he ever had a chancre. In these instances the discharge from the chancre, issuing from the meatus, was mistaken for a urethritis.

DIAGNOSIS.

We should always avoid haste in making a diagnosis of chancre, and, if any doubt exists, we should await the development of secondary symptoms.

In the case of a sore appearing a few days after coitus it is often impossible to exclude syphilis until at least three weeks have elapsed, on account of the possibility of a *mixed infection* having occurred.

When in doubt as to the diagnosis, we can wait for secondary symptoms—*i.e.*, eruption, mucous patches, alopecia, fever, and headache—to confirm it, or we can make the diagnosis by confrontation.

Diagnosis by confrontation is made by examining the individual from whom the patient acquired the sore, in order to determine the presence or absence of syphilis.

The *most reliable diagnostic points* of chancre may be summarized as follows:—

I. Indolent painless swelling of the nearest lymphatic glands, which are polyganglionic, *i.e.*, arranged in a chain.

II. Induration of the base of the sore, which consists of a hard, cartilaginous induration, and feels like a foreign body imbedded in the tissues.

III. History of the period of incubation, lasting about three weeks.

DIFFERENTIAL DIAGNOSIS BETWEEN CHANCRE AND CHANCROID.

CHANCRE.	CHANCROID.
Incubation:	*Incubation:*
Three weeks.	Two to three days.
Commencement:	*Commencement:*
Begins as erosion or papule, which undergoes superficial ulceration.	Pustule or ulcer, and remains so.
Numbers:	*Numbers:*
Single generally. If multiple, so from beginning.	Multiple from beginning or becomes so by autoinoculation.
Edges:	*Edges:*
Level or sloping and adherent, giving "scooped-out appearance."	Abrupt and undermined.
Floor:	*Floor:*
Smooth, shining, red, or raw; covered with slight deposit.	Rough; worm-eaten; "wash leather" in appearance; yellow exudate.
Secretion:	*Secretion:*
Scanty; slightly purulent; not autoinoculable.	Abundant and purulent; autoinoculable.
Progress:	*Progress:*
Slow.	Rapid.
Induration:	*Induration:*
Constantly present.	None or boggy.
Pain:	*Pain:*
Absent.	Painful and inflamed.
Bubo:	*Bubo:*
Constantly present. (See table in section on "Bubo.") Rosary form.	Occurs in 1 out of 3 cases. Packet form.
Scar:	*Scar:*
Heals without scar.	Scar always remains.

The *Holländer hot-air apparatus* is useful in making a differential diagnosis between chancre and chancroid.

After being treated with the hot air, a chancroid can be easily removed with a sharp curette, while a chancre is so dense and firm that it cannot be scraped away.

Carcinoma may be differentiated from chancre by its slow growth and absence of constitutional symptoms. The inguinal glands in carcinoma enlarge later in the disease.

A gumma of the glans presents great difficulties in the way of diagnosis. The chief differential point, however, is that enlargement of the inguinal glands is not present.

In the presence of a chancre with a phimotic foreskin, the chancre can be felt under the skin.

In women it is often difficult, or even impossible, to find the chancre among the folds of the labia.

When an extra-genital chancre is present, the nearest lymphatic glands are irregular and are often in the form of "packets;" the extreme enlargement being due to mixed infection.

PROGNOSIS.

It may be stated, in a general way, that the severity of the chancre bears some relation to the gravity of the secondary manifestations. When the chancre is benign, it is probable that the secondary lesions will be superficial and of a mild type, which can be explained in the following way: In a debilitated individual the tissues react more violently to the syphilitic poison, and consequently both chancre and secondaries are more severe, while, on the other hand, the tissues of a vigorous, well-nourished person are in better condition to resist the action of the poison.

The type of chancre, however, is no indication as to the severity of tertiary lesions, and the severest tertiary accidents often follow a mild chancre.

This is sometimes, no doubt, due to the fact that treatment is often neglected or insufficient in mild cases.

TREATMENT OF CHANCRE.

The cardinal rule in the treatment of chancre is to *avoid every form of irritation;* caustics, strong applications, or mechanical irritants should never be used.

When the chancre is located on the **integument**, a *moist dressing* should be used, consisting of a piece of cotton or gauze, soaked in bichloride solution (1 in 2000), extract of hamamelis, Listerine, Thiersch's fluid, or black wash, and covered with a piece of gutta percha tissue, to prevent evaporation.

If the chancre is located **beneath the prepuce**, a simple dusting-powder of calomel powder, which is covered with cotton, forms a suitable dressing that absorbs the discharge and prevents the open sore from being infected with pus-organisms, and when the chancre is ready for absorption, *mercurial plaster* is a useful application, as the local contact of the mercury with the chancre hastens its disappearance.

When much ulceration is present, iodoform may be used to advantage.

For a *chancre of the tonsil* the best remedy is a daily brushing with a 1-per-cent. sublimate solution.

A primary lesion on the lip, while moist and secreting freely, responds well to applications of liq. ammon. acetatis, and after it is dry and beginning to heal, an ointment of hydrarg. precip. albæ, 10 per cent. in vaseline, is useful; and later when only the induration is left, mercurial plaster may be used as an absorbent.

ABORTION OF SYPHILIS AFTER INFECTION.

It is commonly held to-day among syphilographers that it is better to avoid giving mercury internally until the secondary symptoms of syphilis appear. It is impossible to abort the syphilis by the premature use of mercury, and the appearance of the eruption is only retarded.

It is believed by Ehrmann and others that the patient is rendered more liable to tertiary affections if mercury is given before the eruption appears, and while it is true that its internal administration causes the rapid absorption and disappearance of the chancre, if used too early in the disease it is detrimental, in the long run, to the patient.

The **early excision of the chancre**, before the appearance of the secondary symptoms, was widely recommended and practiced a few years ago, upon the ground that the virus was strictly localized to the chancre and the tissues in its immediate vicinity, and that the poison might be entirely removed from the body by excising the sore.

Of course after enlargement of the inguinal glands such a course would be absolutely futile.

Wolff, in Strasburg, excised the chancre in 500 cases, and in only three of them secondary symptoms did not appear.

In the three cases which did not develop syphilitic manifestations, the correctness of the diagnosis is always open to question, and at the present time the procedure of excising the chancre is regarded as useless in aborting syphilis. Equally worthless is the method of injecting antiseptic solutions into the lymphatic glands, which was tried by Tommasoli, but without effect.

CHAPTER XXI.

SYPHILIS.

SYPHILIS may be defined as a chronic infectious disease, due to a specific poison, probably a micro-organism. Its local manifestations are, primarily, inflammatory changes, beginning in the coats of the blood-vessels and involving the perivascular tissues. After two or three years its contagious element disappears, and the disease assumes the nature of a diathesis.

THE VIRUS.

The virus, or poison, of syphilis is, in all probability, a micro-organism, although it has not yet been demonstrated with certainty. The proof tests, which bacteriologists insist upon, of isolation of the bacillus, its cultivation, and the subsequent production of the parent-disease by inoculation of the cultivated organism into a healthy animal, have not as yet verified the existence of the specific organism.

In the last twenty-five years as many different organisms have been found by different observers, which for a short time have been supposed to be the etiological factor in syphilis.

A few months ago, Schaudinn and Hoffman discovered a new organism, and while it is not yet absolutely proven to be the cause, there is at all events a strong probability that it is the specific organism of syphilis.

It has been named by its discoverers **spirochæte pallida** and is found in the primary sore, moist papules, in lymph glands, in papules on the body, in the spleen, in mucous plaques in the mouth, and also in the blood, but not abundantly in the last.

It is also found in cases of congenital syphilis in all the organs, in the contents of vesicles, in the kidney, liver, spleen, and bone-marrow.

The spirochæte pallida has only been found in syphilitic lesions and never elsewhere.

Metchnikoff infected six apes with syphilis, and found spirochæten in four.

A different form of spirochæte, which is thicker and with flatter spirals, was found by Schaudinn in ulcerating carcinoma, in simple papillomata and erosions of the penis, and in angina of the throat, and it is called spirochæte refringens.

Siegel found flagellates, which he regarded as the organisms of syphilis. He found them in the initial lesions of syphilis, in apes, also in the foot-and-mouth disease in animals, in scarlatina and variola.

In syphilis these [illegible] in the deeper tissues, but in other diseases are found in the epithelium.

It is very improbable that Siegel's flagellata are the exciting cause of syphilis, while Schaudinn and Hoffmann's experiments have been confirmed by twenty other investigators. (Hoffmann.)

Cultures have not yet been made of the spirochæte pallida, because no culture medium has been found as yet upon which they will grow.

CARRIERS OF THE POISON

The virus of syphilis is contained in the secretions, which are derived from the lesions of the primary and secondary stages, and in the blood, milk and semen.

The physiological secretions, [illegible] urine, sweat and saliva, do not contain the poison of syphilis except when mixed with secretions from specific lesions. The pus derived from acne and scabies pustules is [illegible] from the poison. To account for these facts it is supposed [illegible] as a fixed and [illegible] does not impregnate the secretions. It is of [illegible] saliva and milk may be contaminated with the discharges from mucous patches from the mouth or nipple.

[illegible] saliva, and for many [illegible] method employed in [illegible] my thanks to Dr. [illegible]

[illegible] Reader.— [illegible] and solution, [illegible] to avoid [illegible] from the [illegible] from [illegible]

[illegible] washing [illegible] appendix.

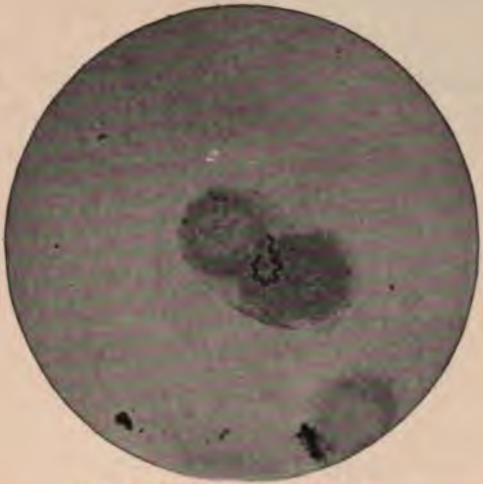


Fig. 145.—Spirochæte Pallida.

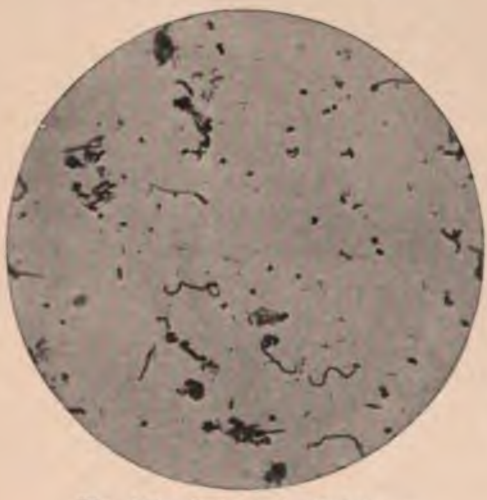


Fig. 146.—Spirochæte Refringens

(Courtesy of Dr. Roescher, Berlin.)

Syphilis loses its contagious quality in the tertiary stage, and the blood and secretions from lesions are no longer capable of conveying the disease.

ANALOGY BETWEEN SYPHILIS AND THE ERUPTIVE FEVERS.

A distinct parallel, which has been pointed out by Jonathan Hutchinson, exists in the course of syphilis and small-pox, measles, scarlatina, etc. All these diseases are due to a special and distinct poison, which is introduced into the body. After a period of incubation, during which the virus increases in volume, its quantity becomes so great that the organism is saturated with it, and constitutional symptoms occur. Each disease runs its own definite and self-limited course, and afterward a condition of immunity follows, which lasts for years, or often for the remainder of the life of the individual.

INOCULATION AND COURSE OF SYPHILIS.

Fournier describes the course of a case of syphilis as a drama or tragedy, with acts and pauses, and represents its course graphically by the following diagram:—

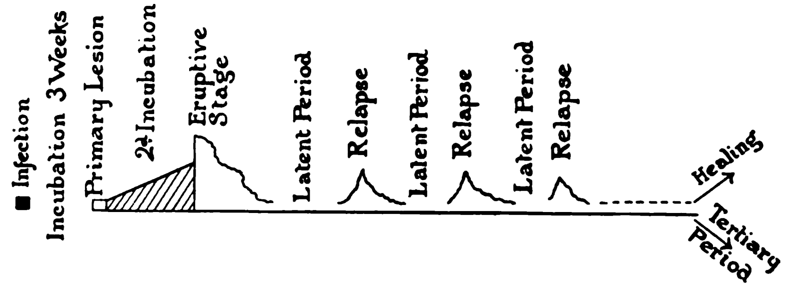


Fig. 144.—Fournier's Syphilis Curve.

After inoculation with the virus of syphilis no symptoms are observed at the point of entrance or elsewhere for a period of *at least three weeks.*

It is supposed that at this time the micro-organisms are too few in number to cause any reaction of the tissues, but, as they increase in number, they induce a condition of local irritation, and the chancre appears. The virus continues to increase, is taken up by the lymphatic vessels and carried to the nearest lymphatic glands, which serve as incubating places for the micro-organisms. The glands undergo enlargement successively, and ultimately the virus reaches the general blood-circulation.

When saturation of the blood has occurred, the fact is announced by prodromata, which are soon followed by an eruption on the skin and mucous membranes. Later the eye, periosteum, and viscera are attacked by inflammatory changes, consisting of arteritis and small round-celled infiltration.

The eruption remains upon the skin for from four to six weeks ordinarily and then disappears, and for a time no symptoms of the disease are present. This interval in the manifestation is spoken of as a **period of latency.**

It is supposed that the poison which has been circulating in the blood was either eliminated or neutralized by the antitoxin formed in the body, but that a certain quantity of virus still remained stored up in the lymphatic glands. As this stored-up virus increases in quantity, fresh discharges of it are thrown into the blood-current, saturation again takes place, and a **relapse** occurs.

Relapses followed by periods of latency occur at intervals of from three to six months during the entire course of the disease, and it is noted that relapses are more apt to take place in patients who have had little or no treatment.

In the majority of cases which receive systematic and adequate treatment relapses cease after from one to three years. But it does not necessarily follow that the syphilis is at an end because a considerable length of time passes without a relapse. After a period of latency, which may extend over many years, new symptoms may again develop.

The *late lesions* differ from the early ones, in that they are of a grave nature and do not tend to spontaneous recovery, but are more apt to destroy the organs attacked. The secretion which they furnish has also lost its contagious properties.

MODE OF INCREASE OF THE VIRUS.

After reaching the blood-current the virus has the property of passing through the walls of the blood-vessels by osmosis, and is deposited at various points in the tissues. Wherever the virus is deposited, local inflammatory infiltration occurs.

As the virus is in these various spots, their secretions and *detritus* can produce syphilis if inoculated into another individual. As a consequence of the growth and activity of the bacteria which we assume to be the cause of syphilis, which are believed to increase and multiply in the chancre, lymphatic glands and all secondary lesions, **toxins** are produced which have a poisonous effect upon the nervous system, and occasion fever, headache, and backache.

STAGES OF SYPHILIS.

It is found convenient to divide the regular course of syphilis into three stages, as follows:—

I. Primary stage, which includes the time from the moment of infection to the outbreak of the general symptoms (eruptions and mucous patches, etc.), and which lasts from eight to ten weeks.

For the first three weeks of the primary stage there are no symptoms to indicate that the individual contains the virus of syphilis in his tissues. At the end of three weeks the chancre appears, and the adjacent glands become enlarged and are the only signs of infection.

II. The secondary stage begins when the eruption, alopecia, and mucous patches make their appearance. It is the stage of typical and regular development of eruptions, their accompanying symptoms and periods of latency alternating with relapses. The secondary stage lasts from six to eighteen months, or about one year on the average.

III. The tertiary stage comes on after a prolonged period of latency, and is the stage of formation of gumma. The tertiary stage may never occur. Its secretions are not contagious, and it resembles a *diathesis* more than an active disease.

INCUBATION.

Definition—The period of time which elapses after the poison has entered the body until the first manifestation of its working appears. The poison is not inactive during this time, but increasing in quantity.

The primary stage of syphilis is divided into two periods of incubation:—

(*a*) *Period of primary incubation*, which is the period from the time of infection until the chancre appears. The chancre represents the reaction of the tissues in consequence of the local increase of the virus.

(*b*) *Period of secondary incubation.*—This is the time from the appearance of the chancre until the eruption is seen. The eruption indicates that the blood is saturated with the virus.

GLANDULAR ENLARGEMENT.

The lymphatic glands are supposed to act as places for the incubation, growth, and development of the syphilitic virus and to serve as store-houses for it, during the entire secondary stage. The glands nearest the chancre begin to enlarge about four weeks after infection.

General Characteristics.—The glands become:—

(*a*) Firm and hard, arranged in a chain, resembling a rosary.
(*b*) Freely movable under the skin.
(*c*) No pain.
(*d*) Rarely suppurate except in strumous or weak patients.

The glands nearest the chancre become enlarged first; consequently we find that, when the chancre is located on the *penis*, the *inguinal* glands enlarge first; when the seat of the chancre is on the *breast*, the *axillary* glands are the first to become affected; and if the chancre is located on the tongue or lips, the *submaxillary* glands are first attacked.

After the syphilis has become general, all the lymphatic glands throughout the body are enlarged, and when located superficially, are easily felt.

For diagnostic purposes, the enlargement of the para-mammillar and post-auricular glands is the most reliable.

The epitrochlear and post-cervical glands are less to be depended upon, as they may enlarge from other causes.

As a general rule the glandular swelling disappears in the tertiary period, *i.e.*, two or three years after infection.

The **lymphatic vessels** lying between the glands often become hard and indurated, feeling like cords, and this condition is called *lymphangitis*.

Course of Virus Through the Lymphatic System.—The syphilitic virus pursues the following course, in its progress through the lymphatic vessels into the general blood-circulation:—

The small round-celled infiltration, which occurs in the chancre, closes up the mouth of the blood-vessels and temporarily holds in check the spread of the poison. The multiple swelling of the lymphatic glands also retards the entrance of the virus into the blood-current.

After the virus begins its increase in the chancre, a part of it is carried to the nearest lymphatic gland, which is a favorable spot for its growth and increase. Part of the virus which is deposited here remains and a part travels farther to the next lymphatic gland.

When the chancre is located on the *penis*, the course of the virus is as follows: Through the inguinal glands, lymphatic glands in the abdominal cavity, receptaculum chyli, and thoracic duct, from which it is poured into the left subclavian vein and general blood-circulation.

During this time the cervical and axillary glands have had none of the virus passing through them. After the blood has become charged with the virus, they filter out the poison, are infected, and become enlarged in consequence.

SECONDARY SYPHILIS.

PRODROMAL SYMPTOMS, OR PRODROMATA.

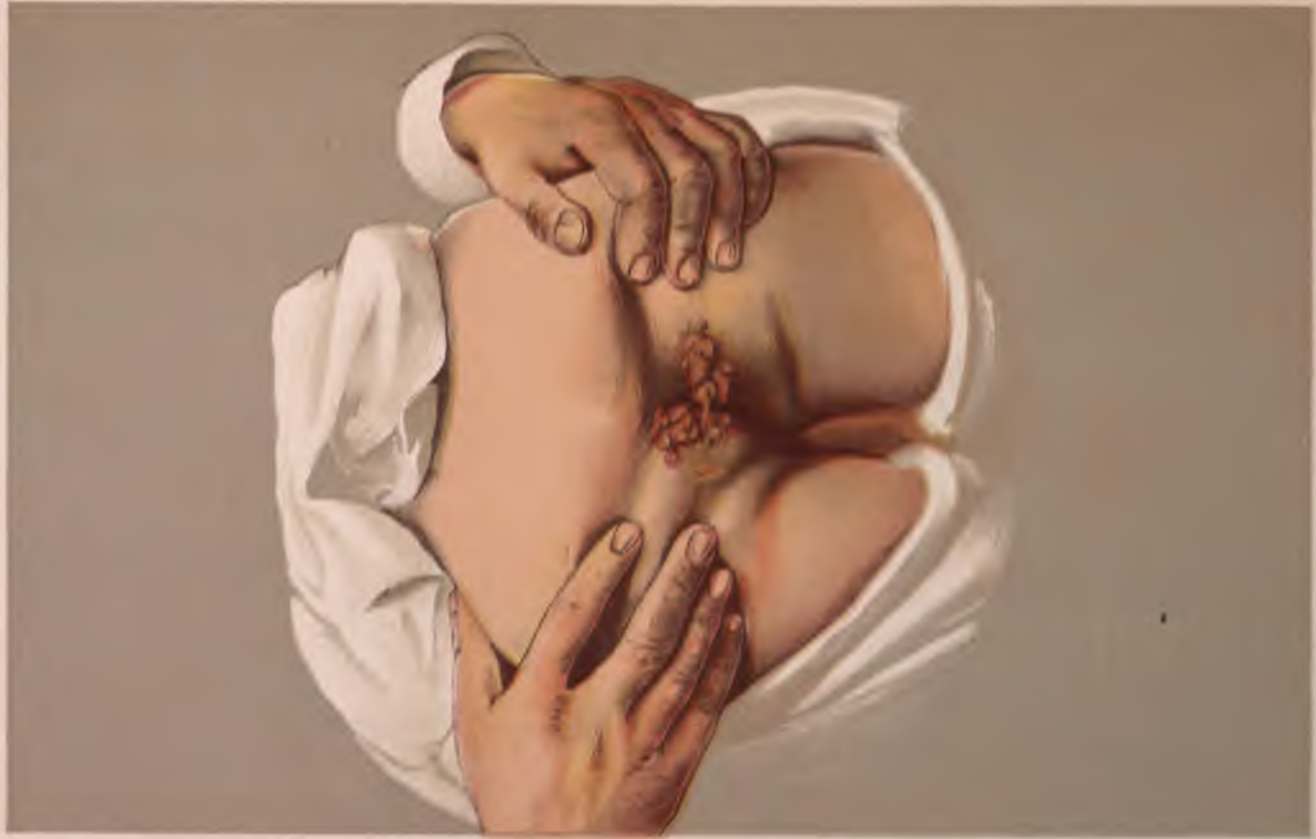
The virus of syphilis has the power of destroying the red corpuscles after it has entered the blood-circulation, and on miscroscopic examination we find that the red corpuscles are diminished in number, with a decrease of hæmoglobin, and that the number of leucocytes is increased. In consequence of these changes the skin and mucous membranes appear *pale* and *anæmic*.

Fever is present in nearly every case. It is usually slight in well-nourished and strong individuals, but in debilitated subjects may reach 103° or 104° F.

Nocturnal Pains.—The shafts of the long bones, such as the tibia and ribs, and the vertex of the cranium are usually affected with pains which are more or less severe, and which have the peculiarity of *remitting through the day and coming on at night, and reach their maximum intensity about midnight.*

The pains are boring or tearing in character, and are called osteoscopic pains (bone-tearing).

The headache and neuralgia are due to a congestion and swell-



CONDYLOMATA LATA, or Syphilitic Papules around the Anus
(Author's case from King's County Hospital).

ing of the periosteum lining the narrow canals of the bones through which nerves pass, and the pain is caused by pressure.

Jaundice occurs in a small proportion of cases, and, while its cause is not definitely ascertained, it is assumed to be due to *either* (*a*) pressure upon the common bile-duct, from the enlarged lymphatic glands lying in the abdomen, or (*b*) from congestion and swelling of the mucous membrane lining the common bile-duct, as a result of the disturbed circulation.

Albuminuria occurs occasionally. It is temporary in character and is due to congestion of the kidneys.

Erythema of the fauces is a most constant symptom, and appears as a generally diffused erythematous redness upon the pillars of the fauces and the pharynx.

The **spleen** is usually more or less enlarged, as occurs in all other infectious diseases.

All the symptoms described above under the term *prodromata* appear before the eruption and mucous patches, and all are occasioned by a disturbance in the local blood-supply, which induces a condition of hyperæmia or active congestion in the various organs affected.

SECONDARY LESIONS.

The mucous patch is one of the most constant and characteristic lesions of secondary syphilis. It makes its appearance about the same time that the eruption is observed. In the earliest stage the mucous patch appears as a pearly-white round spot upon the mucous membrane of the mouth, entrance to the vagina, margin of the anus, or under the female breast. Its development may occur wherever the skin is thin and delicate and kept macerated by secretions.

As it is seen first, the mucous patch looks as though nitrate of silver had been brushed over the surface. After a little time, the infiltrated pellicle of the mucous membrane sloughs off, leaving a shallow, sharply-defined, "punched-out" looking ulcer. This might be regarded as the second stage of the process, and is the form in which the mucous patch is most commonly seen.

The condyloma may be looked upon as the third stage in the development of the mucous patch, and is brought about by the active growth and proliferation upon the floor of the ulcer. The result is the formation of cauliflower-like granulations, which rise in little hillocks, above the level of the surrounding healthy skin.

The secretion which is very abundantly furnished by mucous patches and condylomata is highly contagious, and is responsible for the transmission of most of the cases of syphilis.

An infiltration of the mucous membrane, followed by ulceration, often occurs upon the tonsils and uvula, and is known as *specific angina.*

It occurs particularly in smokers, and is very infectious.

Another condition which affects the mouth, particularly in late syphilis, consists in an infiltration of the tongue, with a thickening and cornification of its epidermis. It is termed *leucoplakia,* and is predisposed to by smoking.

It is a question whether it is a syphilitic manifestation or not.

ALOPECIA.

In many cases of early secondary syphilis, although not invariably, the hair falls out to a greater or less degree.

Alopecia occurs in various forms. It may be *complete,* in which case the hair of the head, eyebrows, and pubes may fall out entirely. The *usual* form, however, consists in a patchy baldness, the hair falling out in small patches of the size of a finger-nail. In some cases there is only a general thinning of the hair, without the formation of any distinct bald patches.

The cause of the local alopecia is from trophic disturbances of the spot, caused by the former presence of a syphilitic papule.

The general alopecia is due to a general trophic disturbance of the skin and nerves from the syphilitic dyscrasia.

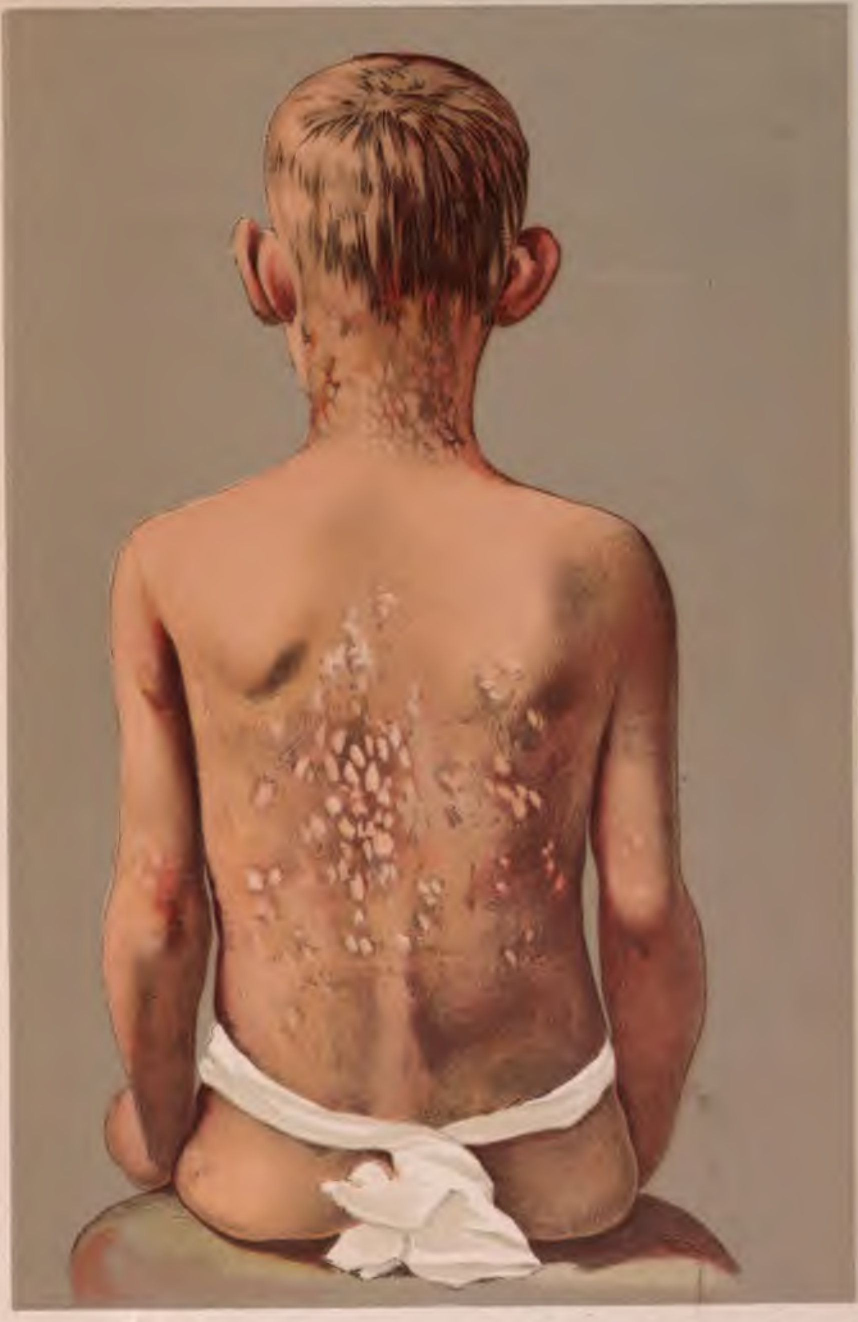
The *prognosis* is good, and the hair always grows in again, unless an ulcerative process has taken place upon the scalp and destroyed the hair-follicles.

The nails are also affected by the general disturbances in nutrition. An inflammation about their roots often occurs, and furrows, running transversely across them, frequently form.

The toe-nails are more often affected than the finger-nails.

SKIN ERUPTIONS, OR SYPHILIDES.

The appearance of the rash upon the skin announces that the blood is saturated with the virus of syphilis. The eruption is sup-



PIGMENTARY SYPHILIDE AND ALOPECIA (Author's case from King's County Hospital). Patient was a female, aged seven years, with acquired Syphilis, and presented a diffuse, wide-spread dark pigmentation over body and neck, with areas of white healthy skin scattered here and there through it. The Alopecia occurred in the form of patches of baldness.

posed to be caused primarily by the irritating effect of the virus upon the vasomotor centers, causing a local paralysis and temporary dilatation of the arterioles in the skin, with inflammatory changes within and around the vessel, at the spot where each lesion is located.

Microscopically all the eruptions of syphilis are identical, and vary in outward appearance only because of the difference in the amount of cellular infiltration.

On microscopic examination all the lesions are found to be due *to two distinct morbid processes*: —

(*a*) Inflammation in the outer and inner coats of the arterioles, accompanied by stasis of blood or hyperæmia in the capillaries.

(*b*) An infiltration of small round cells, as the result of the inflammatory process, which begins in the arterioles and spreads outward toward the periphery, in the tissues surrounding the vessels. At times the changes of arteritis and cellular infiltration are so great that the circulation of the blood through the vessels is cut off, and the parts supplied become the seat of coagulation-necrosis, and slough out.

Classification and Anatomy of Eruptions Occurring in the Secondary Period.—*I. Macular Syphilide.* Synonyms: Syphilitic erythema; syphilitic roseola.

The pathological change in the skin which is the seat of a macular syphilide, consists in periarteritis and endarteritis, with an excess of blood in the capillaries; but while the round-celled infiltration has taken place in the tissues, it is so slight in amount that it can only be detected by microscopic examination.

The spots may be large or small and are symmetrical in their location, being found upon the chest, abdomen, back, sides of the breast, and rump. The macular syphilide is very temporary in its duration, and disappears in a few days by a process of enlargement of the spots at the periphery, and their becoming pale in the center.

The **Hexheimer reaction** is a useful diagnostic measure.

It is made by injecting mercury hypodermically. After the first injection of mercury a bright red or copper-colored zone is noted around the old macules.

The presence of this zone is characteristic of syphilis, and is *diagnostic.*

In the presence of a macular syphilide, care should be taken to distinguish it from other skin eruptions, which resemble it closely, *i.e.*, measles, typhus, urticaria balsamica, pityriasis rosea, and tinea versicolor.

When the macular syphilide is marked in its extent, and a considerable amount of round-celled infiltration has been produced, it is readily perceptible, and forms nodules or small tumors, which are spoken of as the

II. Papular Syphilide.—The papules forming this variety of syphilide may be as large as a 10-cent piece or as small as a pin's head, and are accordingly classified as the *large* or *small papular syphilide.*

In certain cases the epidermis covering the papule scales off, but remains partly attached, and the syphilide is then spoken of as *papulo-squamous.*

If the center of the papule becomes necrotic and breaks down, a funnel-shaped depression is formed, which is filled with pus and covered over by a scale of epidermal covering. This variety is known as the *papulo-pustular syphilide.*

The papular syphilide disappears by absorption, but generally leaves pigmented spots at the former site of the papules, which ultimately disappear.

The *small papular syphilide* is not symmetrical in its localization, and sometimes itches, and on healing occasionally leaves scars. Care should be taken to differentiate it from lichen ruber planus, or lichen scrofulosorum.

The papules are sometimes grouped in circular form, localized around the mouth, nose, and genitalia. When so arranged, the lesion is termed the *circinate* or *annular syphilide*, and must be differentiated from herpes tonsurans or lichen ruber.

III. The Pustular Syphilide.—The pustular syphilide is formed from a pre-existing papule whose central part undergoes necrosis and, as a result of obliteration of the arterioles from endarteritis and periarteritis, sloughs and breaks down. The process is then complicated by the inoculation of pyogenic micro-organisms. These cause a suppuration of the central part of the papule, and the pus accumulates underneath a covering of epidermis, which is raised up above it and prevents its escape.

The pustular syphilide only occurs in debilitated or cachetic individuals, and as it may develop with a prodromal rise of temperature, may easily be mistaken for variola.

IV. The Pigmentary Syphilide.—This form of syphilide, some-

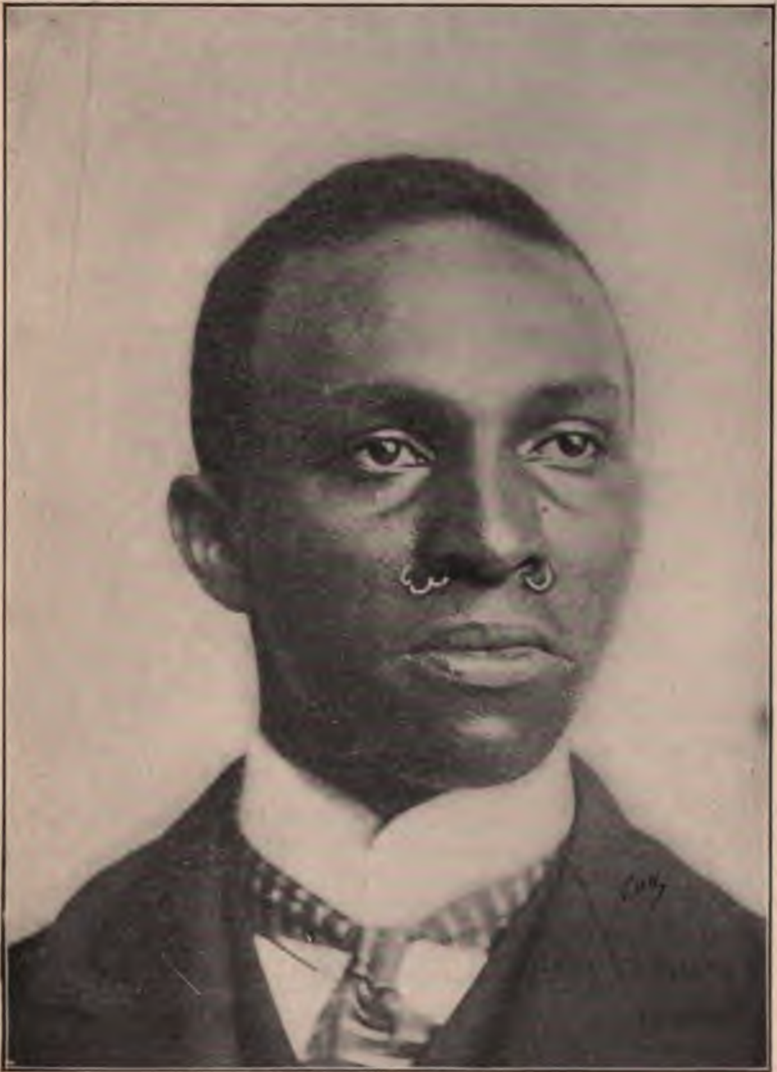


Fig. 147.—Circinate Syphilide. An early secondary lesion and variety of the macular form of syphilide. (Author's case, from Polhemus Clinic.)

times termed *leucoderma syphilitica,* should not be confounded with the pigmentation which remains after the disappearance by absorption of a papule.

The pigmentary syphilide occurs as an independent eruption upon a spot which was not previously affected. It is occasioned by the endarteritis and periarteritis, which allows the red corpuscles of the blood to escape through the vessel-walls into the tissues. The hæmoglobin of the escaped blood becomes dark brown in color, occasioning a pigmented appearance of the skin, and is ultimately absorbed, leaving the skin whiter in appearance than before.

The pigmentary syphilide occurs in *two forms:*—

(*a*) As dark brown spots or patches of brown pigmented skin.

(*b*) As a diffuse, wide-spread, dark pigmentation, with areas of healthy white skin scattered here and there through it. In this form (*b*) absorption of the hæmoglobin has taken place in certain areas of the pigmented patch, leaving white spots free from pigment.

The pigmentary syphilide appears on the neck and sides of the throat, and nine-tenths of all the cases occur in women. It begins in the third or fourth month of the disease, and remains in evidence from one-half to two years.

Distribution of Syphilides over the Body.—The portion of the skin attacked and the extent of the eruption depend upon the age of the syphilis.

The early eruptions which occur during the first six months are:—

(*a*) Superficially seated in the skin.

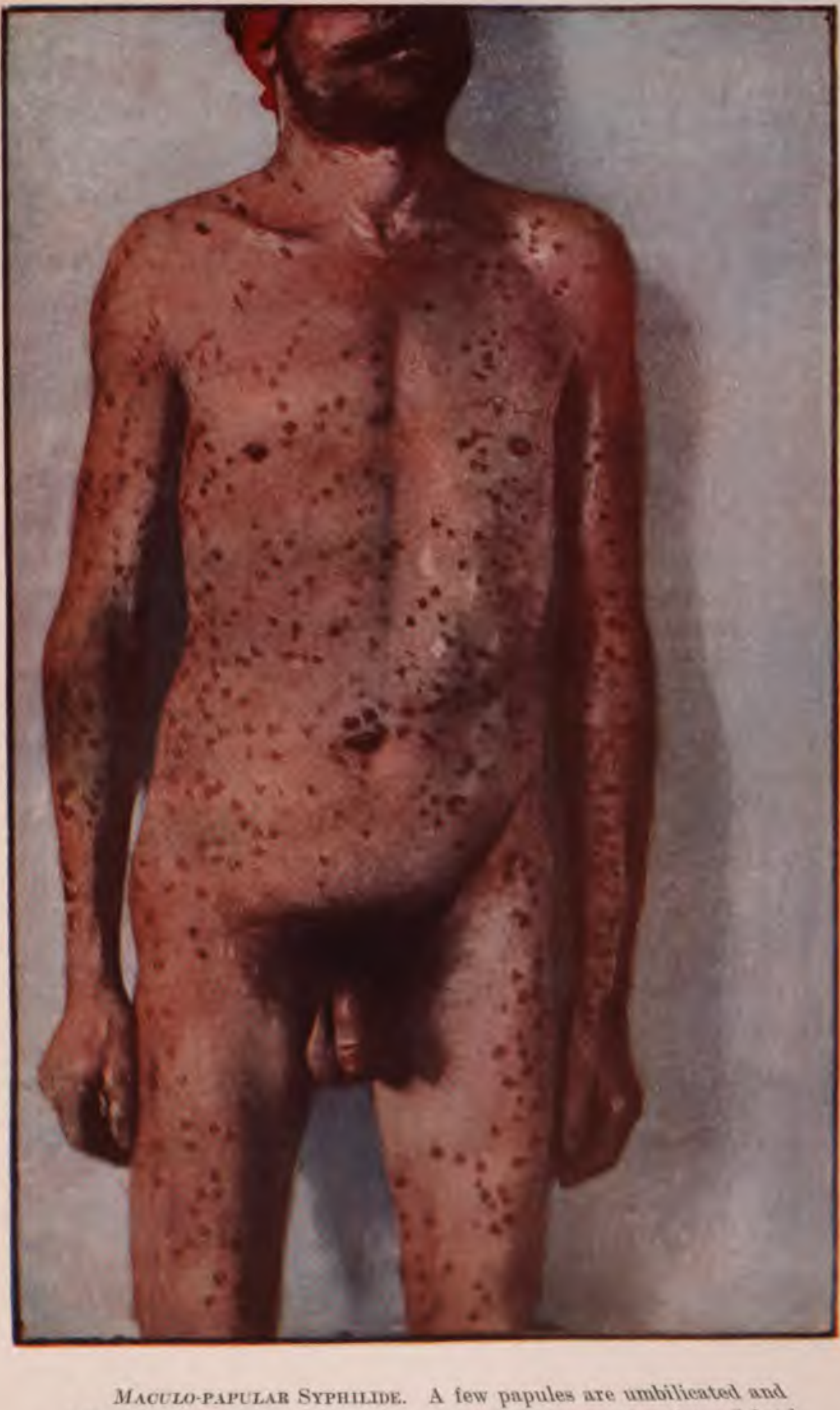
(*b*) Generally distributed over the body, appearing first upon the chest and abdomen and spreading subsequently to the palms and soles.

(*c*) The eruption is symmetrical, occurring alike on both sides of the body, and tends to arrange itself along the course of the connective-tissue bundles which lie under the skin (called lines of cleavage).

(*d*) The early eruptions generally disappear spontaneously by absorption.

Relapsing Syphilitic Eruptions.—The relapses occur after the first six months, and differ in the following particulars from the early eruptions:—

Distribution.—(*a*) While they may be distributed over the entire



Maculo-papular Syphilide. A few papules are umbilicated and a few are beginning to scale on top. (Author's case from Long Island College Hospital.)

body, the relapsing eruptions are never so numerous as the early lesions.

(*b*) They do not follow the lines of cleavage, but are arranged in circles or segments of circles.

(*c*) The groups of lesions do not tend to arrange themselves symmetrically, as a rule, but have certain *spots of predilection*, such as the genitals and anus, the mucous membrane of the mouth, the palms and soles, the upper margin of the forehead near the hair, and the flexures of the joints.

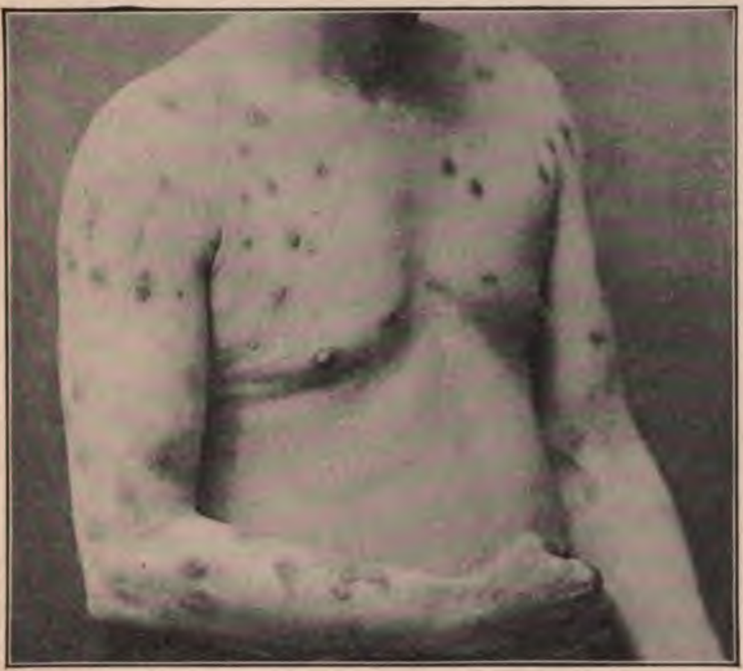


Fig. 148.—Large Papular Syphilide. (Courtesy of Dr. Colby.)

(*d*) The later eruptions are less apt to be absorbed than the early lesions, but tend rather to break down and ulcerate.

Course of the Eruption.—Syphilides are temporary formations which grow and spread at the periphery, or outer edge, and after reaching a certain height *absorption* or *ulceration* takes place, beginning in the center.

In this way the *ring formation* occurs. The center, or oldest part, has been absorbed and has disappeared, leaving the most recently formed portion of eruption still present as a ring around the healed center.

Retrogressive Changes of Syphilides.—As stated above, the process of absorption always begin in the *center* of the lesion.

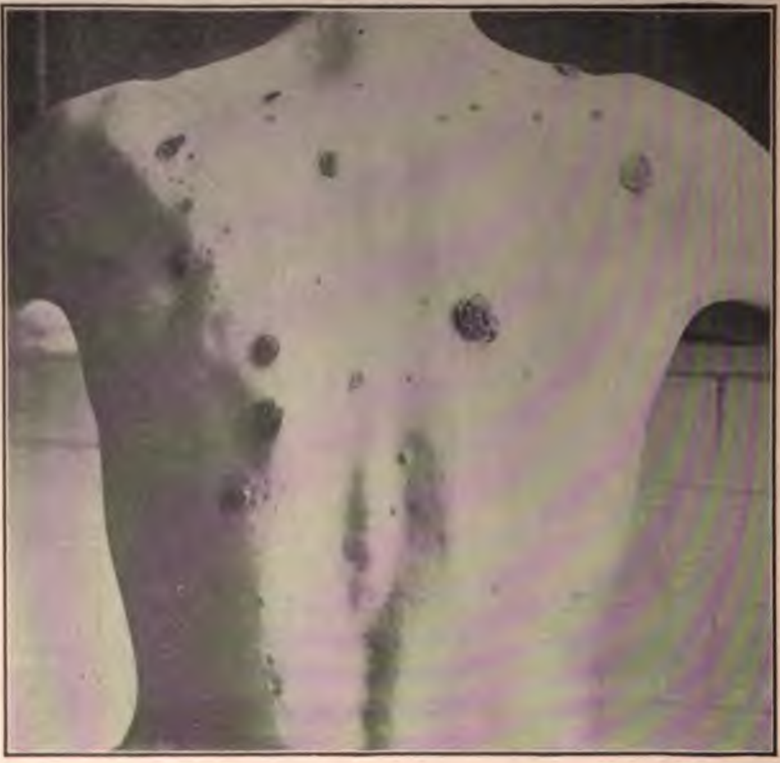


Fig. 149.—Malignant Syphilis. Pustular eruption. (Author's case from Polhemus Clinic.)

The *macular* syphilide disappears most readily, and, if pigmentation were formed, it is soon absorbed, leaving the skin *whiter* than normal.

In the *papule* the central part is absorbed, leaving a depression, which is filled with epidermal scales.

The *pustule* is formed from a papule, and has a crater-like de-

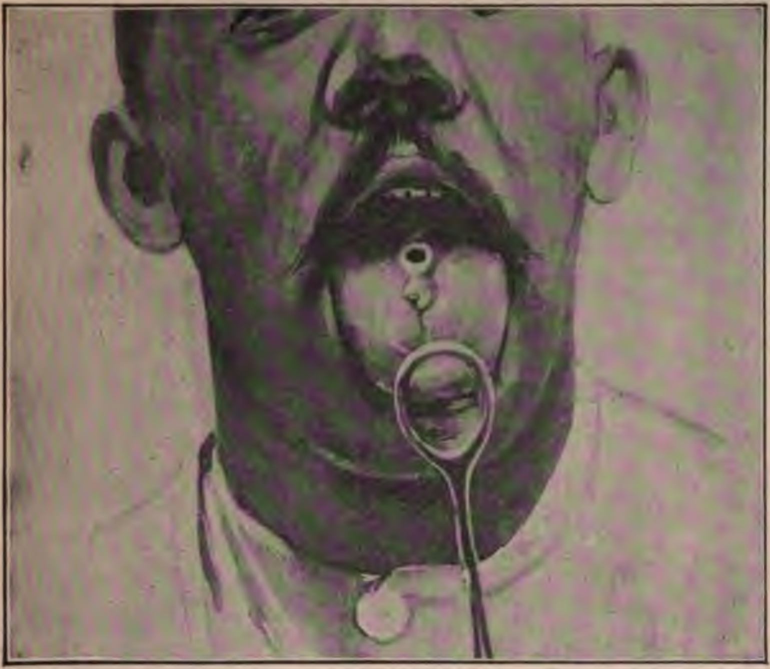


Fig. 150.—Gummata of the Tongue. The one in the middle has undergone coagulation-necrosis of its centre. (Author's case, from Kings County Hospital.)

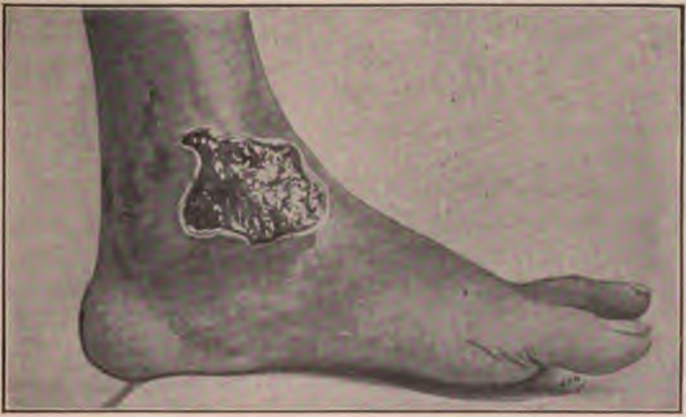


Fig. 151.—Ulcerating Gumma of the Ankle. (Author's case, from Kings County Hospital.)

pression in its center filled with pus; this dries up and forms a crust, and the surrounding ring of infiltration is removed by absorption.

The papule and pustule leave traces of their presence, as spots of pigmentation, which remain on the site of the original lesion for a long time.

If the pustule has caused much necrosis of the normal cutaneous elements, a cicatrix will be formed.

Symptoms of Syphilides.—I. Arrangement of the lesions. II. Polymorphism. III. Color. IV. Absence of burning and itching.

I. The *arrangement* has already been considered, and depends entirely on whether the syphilide is early or one of the late relapsing eruptions.

II. Polymorphism is the most valuable diagnostic sign of a syphilide, and pertains to both the early and late varieties of eruption. Polymorphism may be defined as *diverse as to form,* and is brought about in the following way: The eruption in syphilis never comes out all at once, but makes its appearance in successive crops. When the eruption is viewed, if it has lasted for some little time, it may be noticed that the *older* spots have undergone transformation, while in the *later* spots the changes are less marked. Hence we find present at the same time macules, papules, and pustules, and the lesions are all of different ages and various stages of development or retrogression.

III. Color. The color of syphilides is frequently compared to that of an old copper cent or of lean raw ham. The color is by no means pathognomonic, as it occurs in most inflammations of the skin which are chronic. It is occasioned by arteritis, which weakens the vessel-walls and allows the red corpuscles to pass out into the surrounding tissues. The hæmoglobin loses its bright-red color and becomes brown.

IV. The absence of burning and itching is not invariable, but is usual, and is accounted for by the slow, chronic character of the development of the lesions.

Duration of Secondary Stage.—The secondary stage lasts a variable length of time, which may be from six to eighteen months, and may be set down as about one year, on the average.

In cases which follow a favorable course, *relapses* cease to occur and the disease appears to be at an end.

It is not possible to draw any distinct line of demarcation between the secondary and tertiary periods, for as the lesions continue to recur they gradually lose the distinguishing characteristics of secondary syphilis and become distinctly tertiary.

In the secondary stage the visible manifestations of the disease occur chiefly upon the skin and mucous membranes, and, while the viscera, eyes, and nervous system are occasionally attacked, they are not apt to be affected.

In the tertiary stage, however, the affections of the skin are trivial in comparison with the damage which may be wrought in other vital organs.

Tertiary Stage.—It is generally considered that tertiary syphilis is not due to the living poison which is active in the primary and secondary periods, but that it is a morbid condition of the tissue cells and blood-vessels, which has been occasioned by the active infection, and which causes the proliferation of cells constituting the *gumma.*

Individuals who are strong and well-nourished and who are systematically and carefully treated for a sufficient length of time rarely develop tertiary symptoms.

Marschalko, in a study of 673 cases, states that as a result of good treatment, tertiary lesions occurred in only 2.7 per cent.; in imperfectly treated cases they occurred in 19.3 per cent.; and under insufficient treatment they developed in 23.9 per cent.

It is evident from these figures that tertiarism is almost wholly due to insufficient treatment or ignorant management.

Tertiary lesions do not occur before the second year (except in malignant syphilis), and when they do occur, they appear in most cases from three to four years after infection, and from this time they occur progressively less in frequency, until about the tenth or twelfth year.

From the twelfth to the twentieth year their appearance is only exceptional, and after twenty years, extremely rare.

The lesions of tertiary syphilis occur first in point of frequency in the skin, next in the nervous system, the bones, mucous membranes, and viscera.

The great danger to the life or usefulness of the individual lies in the occurrence of the lesions of tertiary syphilis in the nervous system, attacking either the brain or spinal cord, and it is in order to prevent these accidents that the treatment should be most actively carried out, especially in the early secondary period of the disease.

While the secretions and tissue detritus of *purely tertiary lesions* are not infectious, we do not know at what period the secondary lesions lose their contagion. The precocious tertiary lesions which appear in malignant syphilis, however, are highly contagious.

Another notable difference between the secondary and tertiary periods is, that while in secondary syphilis the lesions run a definite and regular course in their development and retrogression, with periods of latency between the eruptions, and are symmetrically diffused over the body, generally superficial, and have a tendency to spontaneous healing, the tertiary lesions act in a directly opposite manner in all these particulars, as will be seen by the accompanying table:—

Characteristics of Lesions of Skin and Mucous Membrane.—The characteristics of the syphilides in the tertiary period differ greatly from the secondaries, and may be summarized as follows:—

I. They attack a limited area.

II. They have a tendency to extend and cause destruction of tissue, with the formation of scar-tissue and its subsequent contraction.

III. They do not tend to spontaneous recovery, but rather break down and ulcerate.

IV. They extend deeply into the tissues.

Tertiary lesions, in whatever organ or structure of the body they may occur, are the direct result of chronic vascular lesions, and are commonly accompanied by the so-called gumma.

PATHOLOGY.

Arterial Changes.—In the tertiary period of syphilis, **arteritis** plays an important rôle. In the *secondary period* the inflammatory changes in the vessels are more apt to involve the *adventitia,* but in tertiary syphilis the *inner* coat is more liable to be attacked.

The chronic inflammation of the vessel-walls causes an infiltration of small round cells to take place between the *intima* and the *endothelial lining* of the artery, and this infiltration ultimately becomes organized into connective tissue. The contraction of the tissue thus formed causes a narrowing of the calibre of the artery, and, indeed, it may lead to the total closure of its lumen, and the vessel becomes transformed into a solid string of connective tissue (endarteritis obliterans).

When the arterial wall is the seat of an inflammatory process

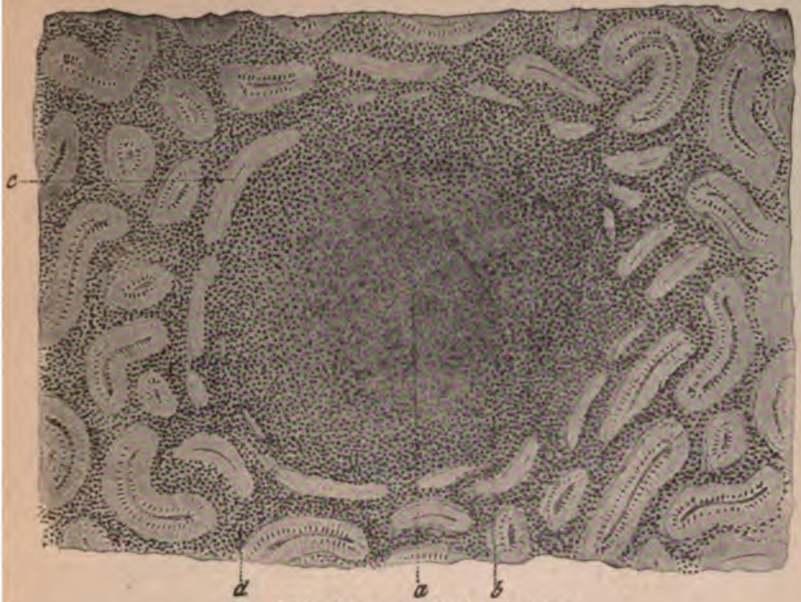


Fig. 152.—Gumma of the Testicle.

a, Central portion, seat of coagulation-necrosis. b, Peripheral zone formed by infiltration of small round cells. c, Compressed tubuli seminiferi. d, Interstitial small round-celled infiltration.

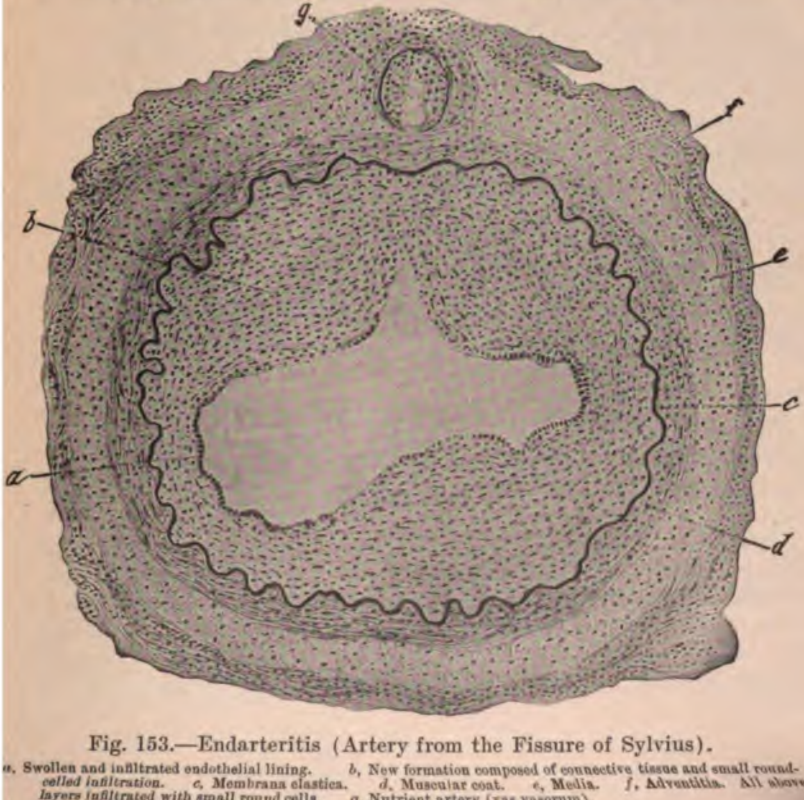


Fig. 153.—Endarteritis (Artery from the Fissure of Sylvius).

a, Swollen and infiltrated endothelial lining. b, New formation composed of connective tissue and small round-celled infiltration. c, Membrana elastica. d, Muscular coat. e, Media. f, Adventitia. All above layers infiltrated with small round cells. g, Nutrient artery (vas vasorum).

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rom "*Die Syphilis* und die Venerischen Krankheiten," von Dr. Ernest Finger.)

which is very *circumscribed,* instead of its lumen becoming narrowed or obliterated, its walls may be stretched and dilated, and in this way small *miliary aneurisms* are formed.

Gummous arteritis is a rare affection, consisting in the formation of small gummata, which grow from the media and push upward, covered by the unchanged intima, into the lumen of the artery. The center of the gumma generally becomes cheesy and breaks down. Obliterating endarteritis can also exist at the same point in the vessel, in addition to the gumma.

Gumma[1] is always preceded by and dependent upon the arteritis. It occurs especially in the skin, periosteum, meninges of the brain and cord, and the abdominal viscera, particularly the liver, spleen, and testicle.

The gumma consists of a circumscribed mass of new tissue, varying in size from a pin's head to a hen's egg, and is composed of a hyaline matrix, in which are imbedded small round cells, and occasionally giant cells. Small gummata may disappear by absorption, but in gummata of larger size the nutrition of the central parts of the tumor is cut off, by the pressure of the hyperplastic tissue on the blood-vessels, and by the accompanying endarteritis, and the centre of the tumor undergoes coagulation-necrosis.

After a gumma has lasted for some time, it is found to be composed of an old central part, made up of fatty, cheesy, broken-down cells, and an outer zone which has been transformed into a fibrous connective-tissue envelope, surrounding the softened sloughing center.

A gumma may exist singly, or there may be several present, lying close together. The circumscribed form of gumma developing in the skin is termed a *syphilitic tubercle.*

CLASSIFICATION OF SKIN ERUPTIONS.

The eruptions which occur upon the skin in tertiary syphilis are all occasioned by the formation of gummata in the skin or subcutaneous connective tissue and their subsequent progress of ulceration, and are classified as follows:—

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[1] The name of infectious granulömata was given by Virchow to a class of diseases whose development does not pass beyond the stage of *formation of granulation-tissue,* which is transitory in the character of its duration and ends by ulceration. In addition, it is nearly allied in its formation to the process of inflammation. The class of infectious granulomata includes syphilis, tuberculosis, leprosy, actinomycosis, mycosis fungoides, rhinoscleroma, and glanders.

I. Gumma: (*a*) Of the skin. (*b*) Subcutaneous tissue.
II. Tubercular syphilide: (*a*) Dry or atrophic. (*b*) Ulcerative.
III. Rupial syphilide.

(a) Gumma of the Skin. (b) Gumma of the Subcutaneous Tissues.—Gumma of the subcutaneous tissues is the cause of the deep ulcerations commonly met with in tertiary syphilis. The skin lying above the gumma becomes attached to it by the inflammation, softens and sloughs away, exposing to the air the cavity which was formed in the central part of the gumma by the coagulation-necrosis of the new infiltrating cells. As the ulcers heal, a cicatrix is formed which dips down into the cavity of the gumma, and a depressed scar, attached firmly to the subcutaneous tissues, remains at that point.

The circumscribed form of gumma which develops in the skin is termed a syphilitic tubercle. This condition is entirely distinct from tuberculosis of the skin, which depends upon the tubercle bacillus, and in this instance the word tubercle means a little tuber, or small nodule. The tubercular syphilide appears in two forms:—

(a) Dry, or atrophic tubercular syphilide, which is so called from the fact that it does not break down and undergo destruction, but tends to dry up and disappear by absorption.

It is this variety of syphilis which occasions the ringed form of eruption which comes on late in the course of the disease. (See plate.)

The atrophic tubercular syphilide often affects the palms of both hands in the secondary stage, or one hand in the tertiary, and is easily mistaken for palmar eczema.

When occurring about the face or on the body, the eruptions may be taken for psoriasis or lupus erythematosus.

(b) The ulcerative form of tubercular syphilide takes its name from the fact that, unlike the atrophic form, it is not absorbed, but breaks down and ulcerates, continually spreading farther at the edge and healing in the centre. From this tendency to extend at the periphery and involve fresh areas of tissue it is sometimes termed the *serpiginous syphilide.*

This eruption must be differentiated from lupus or epithelioma, and in doubtful cases it may be necessary to put the patient on antisyphilitic medication in order to decide the question.

The rupial syphilide derives its name from the concentric rings of crust which form the scab, resembling the rings of an oyster-shell. The formation of the rings occurs in this manner: A small gumma forms in the skin, ulcerates, and the ulcer is covered with a crust. The ulceration extends at the periphery; a ring of crust is formed over the new ulceration and lies underneath the first crust and, as it is larger in size, projects all around it. As the ulceration extends, other layers of crust are formed underneath the original ones, and each additional crust which forms is larger in diameter than the one preceding it and is not entirely covered, so that the edge is seen forming a ring around the crust above it.

The lesions above described are all deeply seated, involve the subcutaneous tissues, and result in more or less destruction of tissue, which is healed by the formation of contracting ciatrices.

SYPHILIS AND IRRITATION.

The predilection which syphilitic lesions seem to show for certain structures may be partly accounted for in the following way: It has long been noticed that any irritation or trifling form of injury in a syphilitic individual predisposes toward the formation of lesions at the injured or irritated point. Frequent examples may be called to mind, as, for instance, the effects of smoking, or the friction from broken teeth in causing sores in the mouth. Pressure contact, if oft repeated and prolonged,—as, for example, the pressure of the forearm upon a desk, in a clerk or bookkeeper,—predisposes to the appearance of an eruption upon the skin of the forearms. A slight blow or squeeze may induce the formation of gumma in the bones or testicles, and, as would naturally be expected, the bones which lie near the surface of the skin—such as the tibia, ribs, and skull—are more apt to be affected by periostitis than the bones which are abundantly covered by a thick cushion of muscle and fat.

Syphilitic lesions also, by preference, affect the *point of least resistance* in the organism. Thus, for instance, syphilis of the liver is more frequent in alcoholics than in abstemious persons, and syphilis is particularly liable to attack the brain and its meninges in individuals who are mentally active and are brain-workers. For the same reason a relapse of a syphilis, which has been latent for some time, is often induced by an attack of malnutrition brought on by want and privation.

MALIGNANT SYPHILIS.

Syphilis is said to be malignant when it pursues a rapid, destructive, and uncontrollable course from the outset, and it often occurs in individuals who are debilitated by tuberculosis, alcoholism, or bad nutrition and privation.

It also sometimes occurs in strong, well-nourished persons. In most cases of malignant syphilis, it has been noted that there is but very slight swelling of the lymphatic glands, and it is supposed that the glands do not filter out the poison, and that it passes rapidly into the blood-current.

The severity of malignant syphilis is increased from the fact that it resists ordinary treatment, for such patients do not stand the administration of mercury and iodide of potash well.

Malignant syphilis usually begins with fever, and the brain becomes the seat of a gumma or an obliterating arteritis.

The early lesions are generally distributed over the body, are pustular in character, break down and cause extensive ulcerations. The anæmia from the destruction of the red corpuscles is very marked, and the cachexia is strikingly evident. The subcutaneous fat is absorbed and the patient emaciates rapidly.

Sometimes the secondary stage is entirely lacking, and gumma develops prematurely, so that four or five months, or at most a year and a half after infection, the most extensive, widespread ulcerations, diffused over the entire body, may be present.

The ulcers often begin without any appreciable preliminary stage of infiltration. Death may result from destruction of some vital organ, or the prolonged suppuration of the ulcers may cause death from amyloid or fatty degeneration of the viscera, or general marasmus.

If the resistance of the system be enough to withstand the drain for two years, the virulence of the disease is exhausted, and the patient may live, but in a weak and debilitated condition of body.

In the foregoing sections we have considered the manifestations of syphilis in the skin and mucous membranes only, but, as has already been indicated, the lesions of syphilis are not confined to any one structure.

The pathological processes of endarteritis and periarteritis, with their accompanying cellular infiltration of tissue and the resulting degenerative changes in the neighboring structures, as well as the gummatous infiltration occurring in the later period of syphilis, are liable to attack any organ in the body, and the symptoms resulting depend wholly upon the function of the organ attacked.

The periosteum of the bones may be affected by the formation of gummata or *nodules*, which occur by preference on the shafts of the long bones, especially the tibia, and the skull.

The bones may be attacked by a form of ***rarefication***, so that they fracture easily, or gummata may form in their substance, with resulting necrosis; or the periostitis may cause superficial caries with fistulous openings through the soft tissues. Osteomyelitis sometimes occurs.

The *muscles*, especially the biceps, may be affected by a chronic contraction, which clears up under the internal use of iodide of potash.

The *joints* are sometimes the seat of pain, without any marked external anatomical change.

The sterno-clavicular joint is most often affected in this manner.

More serious lesions, however, are apt to occur in the joints, leading to arthritis, hydrops, necrosis, formation of fistulæ, and permanent contractions.

Many affections of the internal organs are caused directly by the endarteritis and arteriosclerosis of syphilis.

In recent times aortitis has been studied, and it has been found that a thickening of the media occurs, causing small folds on the inside of the aorta, from the formation of connective tissue.

The *heart muscle* may be attacked with a syphilitic myocarditis, often resulting in sudden death.

The *liver* may be the seat of a hepatitis resembling a cirrhosis from alcohol, and the kidneys are occasionally involved.

The *nerves* may be affected, particularly those lying in narrow canals.

In early syphilis they may be injured through pressure caused by a congestive swelling of the periosteal lining of the canal, and in the later periods, from the pressure from a periostitis.

Diseases of the nerves are often associated with and dependent upon periostitis of the skull.

Secondary epilepsy is caused in this way, *viz.*, by pressure from a periostitis of the inner table of the skull, which may cause single muscle-groups to be affected.

In the tertiary period, the disturbance of the function of nerves

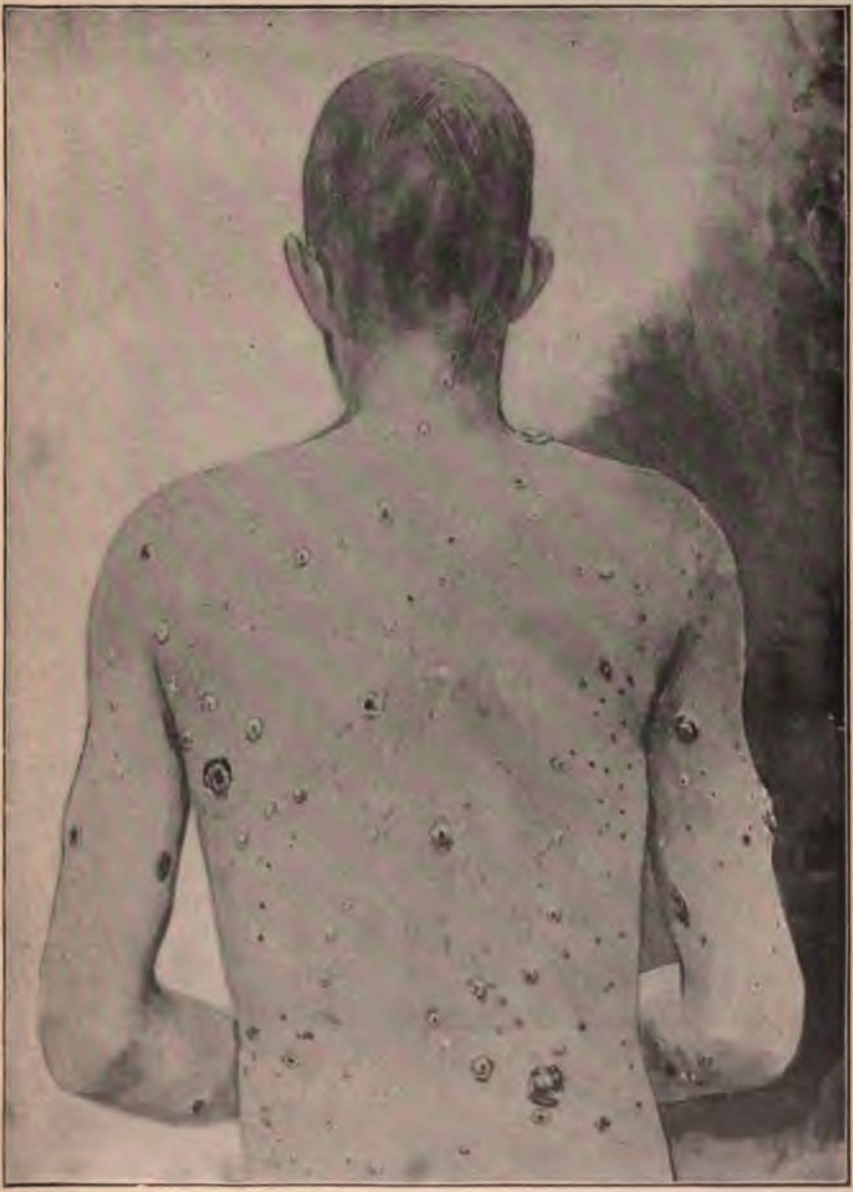

Fig. 154.—Pustular Syphilide (malignant syphilis). (Author's case, from Kings County Hospital.)

may be due to the formation of gummata in their substance. When gummata are formed in the *sensory nerves*, pain is caused at first, and later, anæsthesia, and when a *motor nerve* is affected, paralysis occurs.

Impairment of the function of nerves, however, through a gummatous infiltration, is unusual, and it is generally caused by pressure.

The *brain* may be affected by an endarteritis obliterans, or a gumma, which is generally peripheral in location, and may soften or be absorbed.

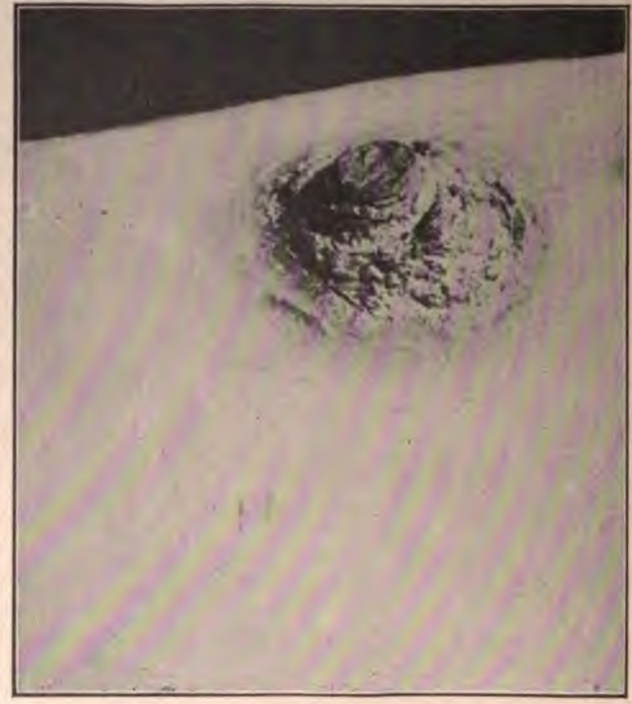

Fig. 155.—Rupial Syphilide. (Author's case, from Polhemus Clinic.)

For a fuller account of the diseases above mentioned, the reader is referred to the text-books on surgery and internal medicine; and the diseases of the nervous system, eye, and ear which depend upon syphilis for their causation are best studied in the special text-books devoted to those subjects.

IMMUNITY IN SYPHILIS.

Immunity may be defined as *the condition of body which resists the growth and pathogenesis of disease-producing germs.*

As in all other infectious diseases, one attack of syphilis protects against others, and it is an event of the greatest rarity for a second infection to occur. The essential nature and cause of immunity, in any infectious disease, is still a matter of speculation. There are three theories at present to account for it:—

I. Phagocytosis.

II. The bactericidal power of the blood.

III. The antitoxins.

The latter theory is not fully established, but it is more generally accepted than any of the others. It is known that bacterial action and growth produce substances called *toxins*, which are poisonous. It is supposed that another set of chemical substances, called *antitoxins* or *defensive proteids*, is being formed at the same time. The antitoxins do not destroy the toxins, but exert some action upon the tissues of the body which causes them to be insusceptible to the action of the toxins.

Immunity may be acquired in three ways:—

I. By means of a first attack.

II. By means of **heredity,** which is the so-called **inherited immunity,** and is demonstrated by the fact that occasionally healthy children are born of syphilitic parents, because the fœtus has acquired its immunity *in utero.*

III. **Acquired Immunity.**—It sometimes happens that healthy mothers who become pregnant with a syphilitic child (infected with syphilis and generated by a syphilitic father at the same time) *may* acquire immunity through absorption of the syphilis antitoxins which have been formed in the fœtus.

CHAPTER XXII.

INHERITED SYPHILIS.

BEFORE studying the effects of syphilis upon the child, it will be useful to consider the ways in which the poison is conveyed to the fœtus *in utero*, and the effects which a syphilitic fœtus may have upon the maternal organism.

MODES OF FŒTAL INFECTION.

Father and Mother both Syphilitic.—It is almost needless to say that when *both father and mother* are syphilitic at the time of conception, the fœtus is almost invariably infected. The children suffer from a severe form of syphilis, and usually die.

Mother alone Syphilitic (Father being Healthy).—If the mother acquires her syphilis *before* conception, the child is almost sure to be infected, as it is nourished directly by the maternal blood containing the syphilitic virus. If the mother is infected with syphilis *after conception*, but during the pregnancy, we have two conditions to consider:—

(*a*) If the mother's infection has occurred in the *early months of pregnancy, before* the independent fœtal circulation has been established, the fœtus is usually infected with syphilis, because the fœtus is nourished *directly* by the maternal blood containing the syphilitic virus.

(*b*) In the later months of pregnancy, however, the fœtus has its own independent circulation. The villi of the placenta are interposed between the fœtal and maternal circulation, and the nutrient material passes from the mother to the fœtus, not by direct interchange of blood, but by *osmosis*.

If the mother acquires syphilis *after* the establishment of an independent fœtal circulation, the villi of the placenta may filter out and prevent the virus from reaching the child: but, as the *antitoxins* are held in solution, they will pass through the membrane of the placental villi and exert an immunizing action upon the fœtus. Hence we have **Profeta's law of immunity:** "Children may be born of syphilitic parents and remain healthy and present an immunity against syphilis which is either absolute or else modifies the syphilis so that it runs a very mild course."

Father alone Syphilitic (*Mother being Healthy*).—Under this head there are also two conditions to consider:—

(*a*) The spermatozoa may contain the virus and carry it to the ovum at the time of conception, and as a result, the child is syphilitic. The syphilis may cause the death of the fœtus *in utero,* interference with development, or simple debility, or the child may be born syphilitic.

Infection of the fœtus by the father is the most common form, but the syphilis resulting is less severe than in the other forms of infection, for the reason that if the mother remains healthy the fœtus is nourished with healthy blood and the harmful effects of the syphilis are partly neutralized.

(*b*) The spermatozoa, however, do not always carry the virus of syphilis to the ovule, and the child often escapes infection and is born healthy.

Influence of the Child's Syphilis as Exerted upon the Mother.—We may now consider the instances in which the *mother is free from syphilis,* but the child has been infected by the *father* at the time of conception. The effects which the child's syphilis cause in the mother must be divided into *three groups:*—

(*a*) In the first group, the mother remains entirely unaffected, and a condition of immunity is *not* established, so that the mother may acquire syphilis from her own child after its birth, or from other sources. These cases are extremely rare, and prove an exception to the generally established law of Colles.

(*b*) The second group forms a large number of cases and comprises the instances in which the mother *is* infected with syphilis from her own child, during its term of gestation in the uterus. The name given to this mode of infection of the mother is *choc en retour,* or *syphilis by conception.* The syphilitic virus formed in the child passes over directly into the mother's blood, through the placental circulation.

(*c*) The third group includes the cases in which the mother is *not* infected from the child *in utero,* but becomes *immune against syphilis,* and is described by **Colles's law,** viz.: "A syphilitic child cannot infect its own mother after its birth." The mother acquires immunity against infection, probably from absorption of the antitoxin of syphilis which is formed in the body of the fœtus. It is supposed that the placental villi act as a filter and allow the antitoxins, which are in a state of solution, to pass through them, by osmosis, into the maternal blood, but prevent the virus from reaching the mother's circulation in any great quantity.

Length of Time After the Chancre at Which Infection of the Fœtus or Choc en Retour is Liable to Occur.—Syphilis is most liable to be communicated to the fœtus or by *choc en retour,* during the secondary period and the first three or four years after the primary sore. As time passes the intensity of the syphilis also diminishes, as is shown by the following table:—

Termination of Pregnancies in a Syphilitic Mother.—I. First pregnancy terminates in an *abortion.*

II. The next pregnancy results in the premature birth of a syphilitic child.

III. Then follows the birth of a full-term child, which has syphilitic manifestations.

IV. Next a child is born at full term, which subsequently develops manifestations of syphilis.

V. Finally, healthy, full-term children are born, which remain healthy and free from syphilis.

It is important to bear in mind that the inheritance of syphilis by the child can be favorably influenced or absolutely prevented by treating the syphilis of the parents, both before and after conception, with mercury.

As a result of the observations made in regard to inherited syphilis, the following principles can be applied practically:—

I. A man or woman with syphilis should not be allowed to marry until three or four years have elapsed since the original infection, and methodic treatment should be carried out during this period.

II. If a married man or woman acquire syphilis, he or she should be energetically treated, in order to lessen the danger of infection of the fœtus in case pregnancy should occur.

III. A pregnant woman with syphilis should be energetically treated during the entire period of pregnancy.

IV. If a woman free from syphilis becomes pregnant, by a syphilitic man, she should be treated, to prevent the danger of *choc en retour.*

V. A syphilitic child should only nurse from its mother, and never be allowed to nurse from a wet-nurse.

VI. A child apparently healthy, although born of syphilitic parents, should never be allowed to nurse from a wet-nurse, until at least three months have elapsed without any symptoms of syphilis developing in the child.

SYPHILIS AND MARRIAGE.

The relation which the question of marriage bears to syphilis is an important one. The lesions of tertiary syphilis are not contagious, and in most cases the infectious element has disappeared after the lapse of two years; and it is positive that a man can only infect a woman during the secondary stage.

In women this is not the case, for it is very common to find syphilitic children born years after the mother's infection. It is supposed that all the ova contained in the ovaries were infected, and continue to hold the syphilitic poison after it has disappeared from other parts of the body.

It is also well ascertained that infection of the child is more likely to occur when it is procreated nearer the time of the mother's infection, and when she has had but little treatment.

For practical purposes a set of working rules may be formulated as follows:—

I. No one showing signs of active syphilis should be allowed to marry, even though more than four years have elapsed since the primary infection.

Marriage should never be sanctioned in men until at least three years have elapsed after infection, provided the patient has been systematically treated during that time: but four years is a safer time-limit and patients should be advised to wait for that length of time.

III. Marriage should not be permitted until at least one year has passed during which *no* symptoms have appeared.

IV. Women should be advised to wait a longer time than four years, on account of the danger of communicating syphilis to the fœtus *in utero.*

INHERITED SYPHILIS.

As already stated in the last section, the parental syphilis exerts a bad influence upon the fœtus, unless a degree of immunity has been induced. In its most active stages the effect of the poison is to cause the termination of the pregnancy in an abortion; but as the syphilis grows older its virulence lessens, so that the next child is probably still-born, and the following one may be born alive, but with the syphilitic taint.

Children which are still-born are usually retained long enough in the uterus after death to become macerated. The epidermis is stripped off or raised up into large bullæ. The liquor amnii is discolored, brown, and foul-smelling. On examination of the infant's viscera, upon the autopsy-table, they are found to be the seat of the characteristic changes of syphilis.

Occasionally children are born of syphilitic parents who have all the manifestations of a florid syphilis upon them, but usually one or two weeks pass before the syphilis becomes visible. In appearance these children are usually ill developed, small, and of light weight. The skin is faded, and they look like little, shriveled, old men.

If the parental syphilis is still older, the children may be born apparently healthy, and develop syphilitic manifestations later. The most common time for their appearance is within the first three months after birth and rarely later than the first six months.

Although children born of syphilitic parents may escape the inheritance of an active form of syphilis by reason of a certain acquired immunity, they may receive a **diathetic taint**, which does not make itself evident by any characteristic manifestations. These children have a feeble constitution and suffer from a general want of mental and bodily development which is particularly notable at the time of puberty.

The children develop slowly, remain small, and are thin and anæmic, and without the power of resistance against accidental disease. The intelligence is often deficient, and such instances are described as cases of **late hereditary syphilis.**

COURSE.

The course of inherited syphilis resembles that of the acquired disease, except that it does not begin from a chancre and that the lesions peculiar to the secondary and tertiary periods appear simultaneously.

When a child is born apparently well, but develops syphilis later, one of the most striking symptoms of the impending outbreak is the nasal catarrh, causing **snuffles.** This is soon followed by an ulcera-

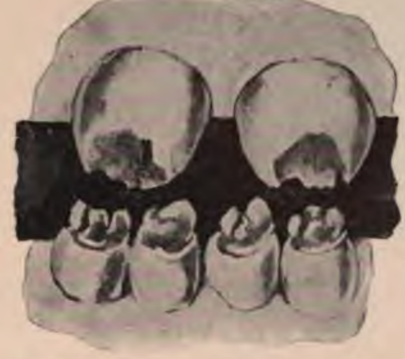

Fig. 156.—Hutchinson's Teeth. These teeth have been recently cut, and the central notch is well outlined, but the thin and unprotected dentine has not yet crumbled away.

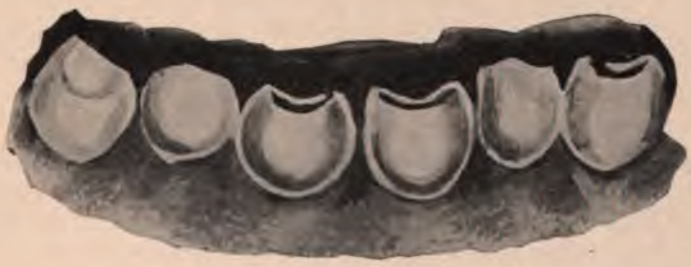

Fig. 157.

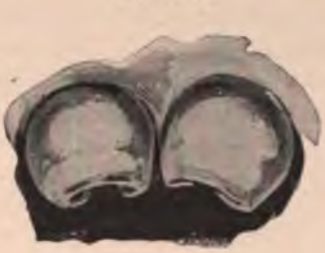

Fig. 158.

Figs. 157 and 158 show later stages of the process after the dentine has been destroyed. The characteristic peg shape, with the vertical central notch, is clearly shown.

tion of the mucous membrane of the larynx, which causes a **hoarse cry.** Mucous patches occur about the skin of the mouth, which interfere with the child's nursing, and the nutrition suffers.

The **eruptions upon the skin** resemble those of acquired syphilis. A *macular eruption* often occurs upon the chest, and a *diffused erythematous redness*, resembling eczema in outward appearance, is often seen about the mouth, navel and parts where the skin is liable to chafe against another opposing surface, such as in the groins, axillæ, or nates.

If the patient is not treated, and in severe cases, the eruption develops into *papules*. The soles of the feet and palms of the hands become the seat of copper-colored papules, which desquamate and are changed into deep *fissures*. The papules located about the mouth, anus, and genitals, are apt to become transformed into luxuriant and vegetating **condylomata.**

An eruption which is unique, inasmuch as it does not occur in adults, but only in children, is *syphilitic pemphigus*, in which large *bullæ*, or blebs, form on the palms and soles, although it sometimes occurs over the entire body. Its formation is explained by the delicate character of the epidermis and the readiness with which serum collects underneath it and raises it from the derma, forming a vesicle or bulla.

Pemphigus is either present at birth or develops in the first week, and the children so affected usually die.

All the above-mentioned eruptions may exist at the same time, and the symptom of *polymorphism* is usually more marked in inherited than in acquired syphilis.

The viscera are affected in inherited syphilis even more frequently than in the acquired form. The *liver* is often the seat of a form of *cirrhosis* occasioned by its infiltration with newly-formed connective tissue, or *gummata* may exist in various portions of the gland. The *pancreas* is affected in a similar way. The *lungs* may be the site of gummata and as a consequence of periarteritis, the frame-work of the alveoli becomes infiltrated with new cells in various areas, causing *white hepatization.*

A very characteristic feature of inherted syphilis is **osteochondritis**, which is considered by some authorities as pathognomonic. It consists in an overgrowth of the cartilage which is interposed between the epiphyses and the diaphyses of the long bones and skull. By palpation, the enlarged cartilage can be felt surrounding the bone

like a collar. The ultimate course of the inflammation may end in suppuration and necrosis and, after extrusion of the dead bone, the injury is repaired by the abundant formation of new bony tissue, called an **osteophyte.** Osteophytes occurring upon the skull give a peculiar "squared" shape to it.

The inflammation involving the cartilages often travels to the **joints,** and a serous or purulent synovitis occurs. **The teeth** of the second set are deformed by a vertical notching and peg shape of the central incisors.

The nervous system suffers as well, and epileptiform convulsions, headache, mental disturbances, idiocy, tabes, and progressive paralysis are frequently seen in syphilitic children.

Hæmorrhagic syphilis exists at birth or else makes its appearance within the first month. It is a condition in which the blood is effused under the skin or mucous membranes, forming large purpuric spots. It is not infrequently met with, and is due to the endarteritis, which permits the escape of blood in greater or less quantities.

RECOGNITION OF INHERITED TAINT.

There are certain points which are of use in making a diagnosis of inherited syphilis at an age advanced from infancy. The most reliable sign is the presence of **Hutchinson's teeth.** The central upper incisors of the second set are the most characteristically affected. The deformity consists in the *peg shape of the teeth* and the *vertical notching in their lower edges.* Jonathan Hutchinson considers them pathognomonic of inherited syphilis, and describes them as follows: "The central incisors are short and narrow, with a broad vertical notch on their edges and their corners rounded off. Horizontal notches or furrows are often seen, but as a rule have nothing to do with syphilis."

The teeth as described are only in evidence until the twentieth or twenty-fifth year.

In the subjects of inherited syphilis the *skin* is thick, pasty, and opaque, or occasionally remarkably soft and silky. At the angles of the mouth may sometimes be noticed *linear scars,* radiating out into the cheeks. The *bridge of the nose* is usually broad and low and a want of firmness in the cartilaginous septum, which allows the nose to be shaken about too easily, is sometimes observed.

The *eyes* are liable to be affected, and the occurrence of a well-marked **interstitial keratitis** is regarded as *pathognomonic* of inherited syphilis. The *skull* is apt to be squared in shape and to show low protuberances in various parts. The *long bones* are often the seat of periosteal thickenings or nodes, and the phalanges and neighboring joints may be affected by a globular swelling, a form of periostitis or ostitis, to which the name *dactylitis* is given.

The *ears* are occasionally affected, and symmetrical deafness, which has occurred without discharge from the ears, is said to be strong corroborative evidence of an inherited taint.

The three most typical symptoms have been grouped together under the name of **Hutchinson's triad,** and consist in (*a*) the interstitial keratitis; (*b*) deafness from disease of the labyrinth; and (*c*) Hutchinson's teeth.

The *mortality* is greater in inherited syphilis when symptoms occur soon after birth, and the children affected with pemphigus nearly all die.

Intestinal diseases are a frequent cause of death, and intercurrent diseases are very apt to result fatally in childhood, so that it is unusual to see an old man with the stigmata of inherited syphilis.

TREATMENT.

It has been thought possible to treat an infant affected with syphilis by giving mercury to the mother and allowing the child to nurse from her breast. It was supposed that enough mercury would be eliminated in the milk to control the syphilis in the child. The quantity, however, eliminated in the milk is too small to be of very much avail, and we are obliged to give specific treatment in other ways.

In the case of a child two weeks or more of age, *calomel,* given internally, is found to be a satisfactory remedy. It may be given in doses of from $^1/_{10}$ to $^1/_8$ grain three times a day.

When the child is three months old, the dosage may be increased to $^1/_6$ grain, three times a day, and as the child grows older, $^1/_4$ or $^1/_3$ of a grain of calomel may be given three times a day.

The administration of the drug should be continued until the syphilitic manifestations have disappeared, and the green color of the fæces which occurs may be disregarded.

Other preparations of mercury are also administered internally with good results, viz., the bichloride of mercury, grain $^1/_{96}$ to $^1/_{60}$, or hydrarg. cum creta, grs. j to vj, three times a day.

With children, as in the case of adults, inunctions are a very useful mode of giving mercury, as in this way digestion is not interfered with.

It is not necessary to rub the ointment all over the body, as in adults, but 30 grains of mercurial ointment, mixed with an equal quantity of lanolin to assist absorption, may be spread on the child's binder, which surrounds the abdomen, and allowed to remain in contact with the skin for two or three days. At the end of that time the ointment may be renewed.

If too much irritation is caused and an eczema follows, the inunction must be suspended and the drug given by the mouth.

In children who develop pemphigus in the first or second week, sublimate baths are effective. A wooden tub should be used, with from 15 to 30 grains of the salt dissolved in the water.

Treatment by *hypodermic injection* has been used by Immerwohl of Roumania, successfully. He uses the following solution:—

℞ Corros. sublimati	grs. 3
Sodii chloridi	grs. 3
Water	180 minims

Sig.: Each minim represents $^1/_{60}$ grain, and an injection of from 2 to 4 minims is made once a week, continuing from 4 to 6 weeks.

As we have already found, in infantile syphilis the division into secondary and tertiary periods is not clearly defined, and the lesions peculiar to both periods often exist at the same time. On this account **iodide of potash** is often called for by the appearance of tertiary lesions at an early date in the course of the disease. Iodide of potash may be given in doses of gr. j three times a day, or it may be necessary to give it in much larger doses, if the lesions are severe.

It is eminently desirable to maintain the nutrition of a syphilitic child, and this can best be accomplished by allowing it to nurse from its own mother. The various forms of artificial feeding are less useful, and should only be resorted to when the mother's milk is insufficient.

Duration of Treatment.—No definite rules can be laid down for the length of time required for treatment. It is considered best to continue for at least two years, with occasional intermissions, but treatment should only be stopped after all manifestations have ceased.

DIAGNOSIS OF SYPHILIS.

The question of diagnosis is an important one, both from the standpoint of therapeutics and also from the necessity of guarding other persons against a contagious disease. Of course, it is more difficult oftentimes to make a diagnosis many years after infection than when the initial lesion, mucous patches, and eruptions are all present. It is always better to conduct the examination in a systematic manner, and begin by taking the **history of the case.**

We should inquire if the patient has suffered from: (*a*) a venereal sore with lumps in the groin; followed by (*b*) a rash upon the skin, (*c*) sore throat or sores in the mouth, (*d*) pains in the bones and skull which were worse at night, (*e*) sore eyes, and (*f*) in women, the occurrence of abortion or still-births.

It is important to bear in mind that syphilis is not always acquired by venereal contact, and the initial lesion may not have been on the genital organs. We should also remember that the early manifestations may have been so slight, particularly in women, as not to have been noticed.

It is well to bear in mind that in men, there is a possibility of the chancre being located within the urethra, without causing any symptoms except a slight gleety discharge, which might be mistaken for a urethritis. The *glandular enlargement,* which is such a valuable diagnostic sign, disappears after two years and is unavailable in general in the tertiary period, but in the secondary period the general glandular enlargement is of great diagnostic value. Of these, the para-mammillar and post-auricular glands are considered the most reliable sign; enlargement of the epitrochlear and post-cervical glands is less to be depended upon, as they also enlarge from other causes.

The eruption, when present, is of great diagnostic value, but oftentimes a considerable knowledge of diseases of the skin is required to make a differential diagnosis between a syphilide and many eruptions which resemble it closely.

The *Herxheimer* reaction is useful in differentiating syphilitic eruptions from other inflammations of the skin. It is made by injecting mercury hypodermically. After the first injection of mercury, a bright red or copper-colored zone is noted around the old macules.

The presence of this zone is characteristic of syphilis and is *diagnostic* (Roescher).

The mucous patches in the mouth, when present, together with the glandular enlargement, are the manifestations most to be depended upon for making the diagnosis.

Late in the tertiary period the diagnosis often presents great difficulties. There are, however, certain **points for examination** which may throw some light on the nature of the case:—

The *skin* and *mucous membranes* should be examined for cicatrices. The *bones* and *testes* may show irregularities or swellings. The *eyes* often show decided changes. Local paralysis of an ocular muscle is a valuable diagnostic sign. Iritic adhesions may be present, or there may be changes in the deeper structures. B. Sachs regards the *action of the pupils* as a very important sign. The changes which occur in syphilitic cases, without previous demonstrable ocular disease, are as follow: I. Inequality of pupils. II. Unequal response to light in one pupil, but not in the other. III. Complete immobility to light and accommodation. IV. Departure from the circular form of the pupil without preceding iritis.

In doubtful cases the diagnosis is sometimes made by the effects of the administration of mercury and iodide of potash. If the lesions improve, it is supposed that they were of syphilitic origin. This is a very uncertain and misleading method of trying to get at the truth, for the reason that mercury and iodide of potash will often cause the absorption of newly-formed inflammatory infiltration, irrespective of its cause. The results of an inflammation which was due to the irritation of any toxic agent in the blood—either uric acid, alcohol, or syphilis—will be absorbed under the use of mercury and iodide, although the infiltration due to syphilis disappears more quickly than the others. (See chapter on "Inherited Syphilis.")

The Justus test in syphilis[1] is based upon the observation that a rapid reduction of hæmoglobin takes place after an inunction with mercurial ointment.

In an untreated syphilis the hæmoglobin is reduced in quantity from the destructive action of the virus upon the blood-corpuscles, and as the syphilis improves, the hæmoglobin is again restored.

If mercury is administered, preferably by inunction, a rapid reduction of the hæmoglobin often occurs within twelve hours, and the percentage increases again in a few days. As treatment is continued, the hæmoglobin is restored to a higher point than originally, and when it remains stationary the lesions begin to improve.

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[1] *Literature.*—Justus, Virchow's Archives, Vol. cxl, page 91, 1895, and Vol. cxlviii, page 533, 1877. Christian, University Medical Magazine, November, 1900.

These changes only occur in active secondary syphilis, and not in the latent or tertiary forms of the disease, or in cases which have been under mercurial treatment for some length of time, and for that reason the reaction in quantity of the hæmoglobin is only useful as a diagnostic measure in the early period of the disease.

The administration of mercury by the mouth is of no use, as its action is too slow, and it must therefore be given by rubbing in ʒj of blue ointment, or by injecting ʒj of a bichloride-of-mercury solution, hypodermically, and the observations are to be made from eight to twelve hours later.

The practical value of the test is still *sub judice.* In the case of venereal ulcers of doubtful origin it is of no value, and while the hæmoglobin reduction is obtained in a certain proportion of cases of active syphilis, it sometimes fails to appear, and also occurs in cases which are not syphilitic.

Spirochæte Pallida.—The constant presence of this organism in early secondary lesions has been used for diagnostic purposes, and although it may not always be found in the chancre or in other lesions where it is present, it is thought to be positively indicative of the syphilitic character of the lesion.

In the cases where for social reasons, or to settle the harassing doubts in a patient's mind, it is desirable to establish a positive diagnosis before the appearance of secondary symptoms, an examination for the spirochætæ by a competent bacteriologist will often decide the question.

PROGNOSIS OF SYPHILIS.

The danger to life, in syphilis in the adult, depends upon the involvement of some vital organ by endarteritis or gummatous infiltration, and this frequently occurs years after infection, when the syphilis is supposed to be extinct; but as already stated, individuals who are strong and well-nourished, and who are systematically and carefully treated for a sufficient length of time, rarely develop tertiary symptoms.

It is, however, impossible to tell the patient at the beginning of the disease whether it will run a mild or a severe course.

The ultimate recovery of the patient depends upon the following factors, of which by far the most important is:—

I. The systematic thoroughness and length of time which the case is treated.

Marschalko, in a study of 673 cases, states that as a result of proper treatment, tertiary lesions occurred in only 2.7 per cent.; in imperfectly treated cases they occurred in 19.3 per cent.; and under insufficient treatment they developed in 23.9 per cent.

The next factor of prognostic value is:—

II. The constitution of the patient.

Any cause which tends to depress the general health—such as privation, bad hygienic surroundings, overwork, anxiety, loss of sleep, and particularly habits of alcoholic indulgence and pulmonary phthisis—are very unfavorable influences.

As in most other diseases, the extremes of life, that is, old persons and very young children, bear syphilis badly, and the death-rate among children with inherited syphilis is high. Syphilis acquired, however, after birth, in the early years of childhood, runs a milder course than with adults. Women are believed to be less severely affected than men, and are thought to be less liable to syphilitic affections of the nervous system.

The appearance of tertiary lesions prematurely, *i.e.*, in the early months of the disease, is a very unfavorable prognostic sign.

Extragenital chancres—*i.e.*, those which are located on the finger, breast, lip, etc.—are more apt to be followed by a severe attack of syphilis than in cases where the chancre is located upon the genitals.

The last factor, or:—

III. The virulence of the poison, is a very uncertain quantity.

It is a fact often observed in former years and generations, that syphilis in certain epidemics was particularly severe in its course, and fatal in its results. This was noted when syphilis was first observed in Europe, in the sixteenth century, and also in the Sandwich Islands, when syphilis was first introduced among the natives.

It is thought to-day by many syphilographers, that the disease is assuming a milder type than in past years.

These facts have been accounted for by various theories: it is supposed that a certain amount of inherited immunity exists among European nations, which mitigates the course of the acquired disease, while when syphilis is introduced for the first time among a new people, there is no inherited immunity among them to protect them from its force.

CHAPTER XXIII.

TREATMENT OF SYPHILIS.

As Syphilis is a general and constitutional disease, dependent upon a specific poison, it is necessary to introduce a remedy into the circulation which will cause either an elimination of the poison or else neutralize it and render it inert and harmless. The drugs which are the mainstay in the treatment of syphilis are mercury and iodide of potash.

Mercury is supposed to have a direct action upon the syphilitic virus, destroying and neutralizing it.

Mercury may be introduced into the organism by three routes:—

I. Through the skin: (*a*) by inunction; (*b*) by fumigation.

II. Under the skin by hypodermic injection.

III. Through the intestinal canal.

It is eliminated by the kidneys, intestinal glands, and by the mucous membrane of the mouth and salivary glands.

After a varying quantity of mercury has been given for some time, the blood becomes saturated with it, and this is announced by the occurrence of **mercurial stomatitis**, which is ushered in by certain **prodromal symptoms**:—

(*a*) A coppery taste in the mouth.

(*b*) An increased flow of saliva.

(*c*) Slight pain on striking the teeth together.

(*d*) Slight swelling and sponginess of the gums next the teeth.

In mild cases of ptyalism the symptoms all subside in a few days if the administration of the drug is stopped; but if an excessive quantity of mercury has been introduced into the body, or if an unusual susceptibility to the action of mercury is present, the toxæmia is indicated by **salivation.**

In severe cases of salivation, the gums and buccal mucous membrane are greatly swollen and ulcerated. The teeth loosen and fall out, the saliva pours out from the mouth in quantities, even to the extent of several pints a day, and the breath has an intensely fœtid odor.

In the administration of mercury in syphilis it is essential to give a sufficient quantity of the drug to produce *ptyalism,* or to "touch the gums," as it is usually called, as this symptom indicates that the patient is getting the requisite quantity of mercury to hold the disease in check. But care should always be taken to stop the mercury before *salivation* is induced.

A bad condition of the mouth and carious broken teeth covered with tartar cause the mouth to react prematurely to the influence of mercury, and for this reason the patient should go to a dentist and have the teeth put in order before beginning treatment.

While patients are using mercury, especially by inunction, it is necessary that they should wash their mouths three or four times a day with strong alum or chlorate-of-potash water, or peroxide of hydrogen. Hospital patients, who, as a rule, do not use the tooth brush, should brush the gums every day with a 3-per-cent. solution of chromic acid.

Light cases of spongy gums may be treated by brushing them with equal parts of tincture of myrrh and tincture of iodine, followed by a mild mouth-wash.

Treatment of Salivation.—The fœtor of the breath and the ulceration can be best checked by means of chlorate of potash in solution, used as a mouth-wash, and it should also be given internally in doses of 20 grains, three times a day. The pain in the gums induced by mastication can be lessened by brushing the gums with a 4-per-cent. cocaine solution before eating, although in severe cases the patient should be fed upon liquid food. The excessive secretion of saliva is controlled, to some extent, by hypodermic injections of atropine. The gums should be brushed with 3-per-cent. chromic acid solution, and the ulceration in the mouth touched with a 10-per-cent. nitrate of silver solution. The elimination of the mercury may be aided by giving the patient abundance of water to drink, and causing free purgation.

In addition to noting the condition of the patient's mouth during the administration of mercury, the state of the stomach and intestines should be closely observed, for the occurrence of cramps or diarrhœa shows that the limit of dosage is reached.

It is important to *examine the urine* before beginning treatment, for even although kidney disease may be present, it is safe to administer mercury. If, however, during the course of treatment, albuminuria occurs, it is evident that the kidneys have been affected by the mercury and its administration must be stopped.

In using the inunctions, it is not infrequent that a mercurial dermatitis follows, from the local irritation of the ointment, but a dermatitis may also occur when mercury is given internally.

MODES OF ADMINISTERING MERCURY.

Inunction.—The method of rubbing mercurial ointment into the skin is the most sure and effective mode of treating an ordinary case of syphilis, and is the *only* plan of treatment to use in the presence of grave lesions threatening life or the integrity of vital organs.

The advantage of inunction is its prompt action in saturating the body with mercury, and it is possible to give three times the quantity of mercury in this way which could be given by the mouth. At the same time the stomach digestion is not interfered with, and the patient can assimilate the maximum quantity of food, and his nutrition is maintained.

The mercury, through the friction and pressure of rubbing, is pressed into the open mouths of the sebaceous follicles and sweat-ducts in the skin. It is brought gradually in contact with the blood circulating in the capillaries of the papillary layer in the skin, and is supposed to be converted into bichloride of mercury through combination with the sodium chloride in the blood. In this soluble form it is thought to pass into the general blood-circulation. The mercury is stored up in the follicles of the skin for a long time after the inunctions have been discontinued, and can be found eliminated by the urine many weeks after the last inunction was given.

The blue ointment, or unguentum hydrargyrum, is the best preparation to use, and it is preferable to have it made after the formulary of the German pharmacœpia, which contains 20 grains of metallic mercury in every drachm of lard. In ordinary cases 1 drachm is a suitable dose, but in exceptional cases 2 drachms may be used.

It is well to have the druggist measure out the daily dose of ointment and enclose it in waxed paper. In very recent times a substitute for the lard, termed *resorbin* has been used with satisfaction. Resorbin is an emulsion made from almond-oil, wax, glue, or soap solution, sometimes combined with lanolin. The advantages over the lard which resorbin possesses are, that it mixes with water, dries quickly, is less dirty, its odor is less unpleasant, and it leaves less deposit on the skin. Resorbin takes the place of lard in the blue ointment in the same proportion.

℞	Mercury	1 part
	Resorbin	2 parts

The ointment should be thoroughly rubbed into the skin, selecting a fresh portion of the surface of the body for each day's rubbing, and it is not practicable for the patient to rub himself, but the inunction should be made by an attendant, or *masseur*.

It requires from twenty to thirty minutes' firm rubbing with the uncovered hand to cause the complete absorption of the entire quantity of ointment used.

It is also desirable to make the inunctions in a regular course, as follows:—

First day: In the calves.
Second day: Inner and outer sides of the thigh.
Third day: Chest and abdomen.
Fourth day: Flexor surfaces of the arms.
Fifth day: Back.

On the sixth day the patient takes a warm bath with soap, and on the seventh day begins again with another course of rubbings.

The absorption of the mercury takes place partly by inhalation, and for that reason the patient should wear woolen underclothes, which are changed once a week, when the bath is taken.

It requires from 20 to 50 inunctions, as a rule, to induce ptyalism, and the *gums should be touched in every case before the inunctions are discontinued.* The inunctions should be used in both secondary and tertiary periods whenever danger threatens a vital organ, such as the eye, brain, larynx, etc., and also in obstinate ulcerative processes with rapid destruction of tissue. Inunction is also the most reliable means of treating the ordinary mild cases of syphilis.

Fumigations of calomel are a useful *adjunct* to other treatment in the cases of early lesions which are extensive and have a tendency to involve the deeper structures, ulcerate, and extend. The calomel-fumes come directly in contact with the lesions, and the local action of the vapor of mercury facilitates their healing.

Method of Application.—The patient sits on a cane-bottomed chair with a blanket around his neck, falling to the floor and surrounding him in a sort of tent. The head is left uncovered. A tin pan holding boiling water is placed under the chair, and the patient steamed for fifteen minutes. The pan is then withdrawn and 30 grains of calomel are fumigated on a tin stand, over a spirit-lamp placed underneath the chair, and the patient is allowed to remain surrounded by the fumes for half an hour. The fumigation should be employed once a day, until the gums are touched.

Sublimate baths are employed in the same class of cases, viz.: extensive, ulcerating, suppurating lesions. The intact skin does not permit a trace of sublimate in solution to be absorbed, but absorption can take place through solutions of continuity.

Intramuscular Injections.—The practice of treating syphilis by hypodermic injections of mercury was first introduced by Lewin, formerly chief of the syphilitic service in the Charitè, in Berlin.

The salts used are *soluble* and *insoluble.*

Of the soluble salts, corrosive sublimate is preferred in the Charitè because it is ropidly absorbed and has an intense action.

The solution contains 1 per cent. of corrosive sublimate, with the addition of 3 per cent. of common salt, which is added empirically, to lessen the pain and danger of causing infiltration in the muscles.

It is the practice in the Charitè to give from fifteen to twenty injections in all, using 2 cubic centimeters, or 30 minims, every second day.

The injections are made with an ordinary hypodermic syringe, provided with a needle which is two inches long and with a thick bore, and the needle is plunged directly downwards into the substance of the glutei muscles.

Instead of using the soluble corrosive sublimate, the insoluble salts of calomel or salicylate of mercury may also be used hypodermically, suspended in oil.

If calomel is selected, it may be used in an emulsion of one part of calomel to ten of olive-oil. Of this emulsion, 1 cubic centimeter, or 15 minims, is injected once a week, and only from four to six injections are given.

In America the salicylate of mercury is chiefly used, as it is less likely to cause salivation. In ordinary cases the injection is made once a week, and from eight to fifteen injections are required to cause a disappearance of the symptoms.

℞ Hydrargyri salicylatis	gr. xxiij.
Lanolini	gr. xv.
Oleum olivæ	mccxviij.

M. Sig.: Inject fifteen minims hypodermically once a week. Fifteen minims contain gr. iss of the salicylate of mercury.

The *advantages* of intramuscular injections are, that they act promptly and rapidly, and are almost, if not quite, as efficacious as inunctions. The dosage is accurate, and the injection is only made once a week when the insoluble salts are used, so that the patient is relieved from the annoyance of taking medicine or making inunctions in the intervals.

The *disadvantages* are the *pain*, which is very inconsiderable, and the slight chance of the occurrence of abscess, which seldom happens.

In exceptional cases the oil has been known to form a *pulmonary embolus*, with a localized pneumonia, but recovery followed in each case.

Salivation may occur in a small proportion of cases, without any previous warning, after one or two injections, and, as the deposit of mercury is in the muscle, we cannot stop its absorption unless an incision is made into the muscle and the small mass of mercury removed by a curette.

As a rule, however, patients can tolerate half a dozen or more injections before the gums are touched, and an improvement in the lesions is noted after the first injection, which continues progressively under the repetition of the dose,

Administration of Mercury by Mouth.—While in Germany the usual method of administering mercury is by inunction, in this country it is the custom to treat syphilis by its internal administration.

In recent times, however, we are coming to the conclusion that it is not enough to rely wholly upon giving mercury by the mouth, but that its action should be supplemented by regular courses of inunctions at different times during the progress of the disease, in order to attain a cure of the syphilis.

If mercury is given by the mouth, after a certain length of time the absorptive powers of the intestinal canal often become impaired, and the mercury passes through the alimentary tract unchanged and without being absorbed. Its continuous use for a long period of time often causes anæmia, emaciation, and diarrhœa.

The internal administration of mercury is appropriate during the intervals of inunction and in the periods of latency of syphilis, but it should never be depended upon in severe cases or grave complications. These require the mercury to be given by inunction or hypodermic injection.

Preparations of Mercury.—*Pills of protiodide of mercury* (Lamoureux & Garnier), $^1/_5$ grain each.

Method of administration.—One pill is given three times a day three-fourths of an hour after eating, and every third day the dosage is increased by one pill. For example, the patient takes 3 pills for 3 days, and on the fourth day he takes 4 pills, and on the eighth day the dose is increased to 5 pills, and so on up to the *point of tolerance*, which is usually from 10 to 15 pills or more.

The point of tolerance is not manifested by ptyalism, except in rare instances, but by *diarrhœa* and *cramps*. When these symptoms occur, the dosage is reduced to a point just short of producing cramps.

According to the recommendation of Keyes, the full dosage is continued until a *period of latency* occurs, when it is reduced to one-half the number of pills and continued. If a *relapse* takes place, the maximum dose is given again.

Another plan of treatment, which is more to be commended, is to ascertain the maximum dose by gradually increasing the number of pills, and, after the maximum dose is reached, it is maintained without reduction throughout the whole course of the disease, unless anæmia, emaciation, diarrhœa, or salivation is produced by it.

Mercury with Chalk (*Hydrargyrum cum Creta*).—This is a mild preparation, and is not apt to produce colic, and for that reason it may be given when the protiodide causes too much diarrhœa. The method of administration is similar to that of the protiodide. It may be given in 1-grain pills and increased to the *point of tolerance*, which is manifested by either ptyalism or diarrhœa.

Bichloride of Mercury.—Dose, $^1/_{30}$ to $^1/_{15}$ grain. This form of mercury is very useful, and is of particular value, given in combination with iodide of potash, later in the disease in the form of the so-called mixed treatment.

Tannate of Mercury.—Dose, $^1/_2$ to 1 grain three times a day. This is one of the newer preparations, and it is said to have the advantage of causing very little irritation to the intestinal canal.

VALUE OF THE METHODS.

The relative value of the methods of treatment by inunctions or hypodermic injections, is in most cases about equal, although fat people, pregnant women, old people, and debilitated and run-down individuals do not stand injections well, and in such cases treatment by inunctions should be employed.

For obstinate affections of the mucous membranes and palmar syphilis, injections of the salicylate of mercury are successful in causing them to heal.

In malignant syphilis, calomel injections are indicated because of their greater activity, and they are also useful in obstinate tertiary affections which do not heal because of frequent relapses.

The internal treatment is most uncertain in its working, but must be used with exceptional patients who do not tolerate inunctions or injections. It is also useful as an adjuvant in the routine treatment of an ordinary case.

Too much reliance is placed in America, upon the treatment of syphilis by the exclusive use of internal medication, and the author believes that many cases of late tertiary lesions of the brain or nervous system would not have occurred, if the patient had been subjected to several vigorous courses of treatment by inunctions or injections during the first two and a half years of the disease.

Iodide of Potash.—The iodide of potash has no direct action in destroying the virus of syphilis, and consequently it is of no use early in the disease. Its action is to cause the absorption of the new growth infiltrating the arteries and which, when it occurs in other tissues, is known as gumma. The iodide in small doses acts as a tonic, and increases appetite, nutrition, and tissue-change.

The unpleasant effects which are induced by iodide of potash are *coryza* and *lachrymation,* and an *eruption* upon the skin, which usually occurs upon the back, chest, and face, or small acneiform pustules. In rare cases large *bullæ* may form or the eruption may be *hæmorrhagic* in character and resemble purpura.

In addition, there is often a condition of anæmia, weakness, and general malaise induced. These symptoms are all less apt to occur if the kidneys secrete freely and the iodide is rapidly eliminated.

Dose and administration.—The only rule for the size of the dose is the effect produced upon the lesion. For the ordinary routine treatment, during a period of latency, 90 or 100 grains a day are enough, but in the presence of a grave lesion of the nervous system or viscera, $^1/_2$ ounce, or even 1 ounce in the day may be required to save life.

Iodide of potash is best given in saturated solution, 1 minim of distilled water representing 1 grain of the salt. It should be given in milk or largely diluted with water, and preferably two hours after a meal, as the iodide combines with the starch in the stomach and forms iodide of starch, which is inert.

When the drug disagrees with the stomach and disturbs the digestion, it may be given in milk, which is coagulated with essence of pepsin, or the patient may be directed to drink one or two glasses of hot water immediately after taking the iodide.

While a small dose of iodide may cause such marked symptoms that the patient insists he cannot continue with it, it is remarkable what very large doses of the drug are generally well borne. In these cases where iodide of potash is imperatively called for, it will be usually seen that if the dosage is rapidly increased the patient soon becomes accustomed to the drug, and the unpleasant symptoms disappear.

In very exceptional cases, salivation of a mild grade has followed the administration of iodide of potash, and this is especially the case where mercury has been previously given; and sometimes iodide of potash has a bad effect upon the heart, causing feebleness of its action, and blueness of the lips and extremities.

When the patient cannot tolerate iodide of potash for any of the above reasons, *iodide of soda* can be used in its place, in doses of from 60 grains up to 300 grains.

This is a much weaker preparation, but does not affect the heart.

Iodipin is a remedy which has been lately introduced into practice, and is active and useful, but not as efficient as the iodides, and should be used only when they are not tolerated.

It may be given by the mouth in drachm doses of a 10-per-cent. solution, three times a day, with a few drops of aqua menth. pip. as a corrective. Its chief field of usefulness, however, is by hypodermic injection, and from 80 to 150 minims of a 25-per-cent. solution should be given at a time.

Zittmann's Decoction.—This is one of the officinal preparations of the pharmacopœia, and is composed of a number of vegetable bitters, together with a minute quantity of metallic mercury. Its action is first purgative and later tonic, and in some way, which is not understood, it exercises a most beneficial effect in indolent, spreading ulcerations which do not respond to mercury and iodide of potash. These lesions occur chiefly in malignant syphilis affecting persons of feeble vitality, who are usually of the tubercular diathesis and who cannot tolerate mercury or iodide of potash in any considerable quantities. It is in such cases as these, says Cooper,[1] that the Zittmann treatment proves most effectual. A fortnight's treatment with this remedy will arrest the disease and will cause rapid healing and cicatrization of the lesions. The principle of the treatment consists in eliminating the poison from the system by sweating and purgation. The patient is kept in a room the temperature of which is maintained at 80° F. The evening before commencing the treatment two of the following pills are administered:—

℞ Hydrarg. chloridi mitis	gr. ij
Ext. colocynthidis	gr. v
Ext. hyoscyami	gr. ij

The diet is regulated, and for the first four days the patient drinks half a pint of the following decoction, as hot as possible, at 9, 10, and 11 A. M., and at 12 M.

DECOCTION I.

℞ Rad. sarcæ contus	℥iv
Sem. anisi contus.	
Sem. fœniculi contus, of each	ʒviiss
Fol. sennæ	℥i
Rad. glycyrrh. contus	℥iv

Add, in a linen bag:—

Sacchar. alb.	
Alum. sulph.	
Hydrarg. chloridi mitis, of each	ʒiss
Hydrarg. bisulph. rub	℈i
Aquæ	Cong. iii

Boil gently down to 1 gallon, strain, and put into four 40-ounce bottles.

On the same days, at 3, 4, 5, and 6 P. M., half of the following decoction, which is taken cold:—

DECOCTION II.

To the dregs from No. 1 decoction add:—

Rad. sarsæ contus	℥ii
Cort. limonis contus.	
Sem. cardamon contus.	
Rad. glycyrrh. contus., of each	ʒi
Aquæ	Cong. iii

Boil gently down to 1 gallon, and put into four 40-ounce bottles.

The patient is kept in bed, except for an hour every evening, when he may sit up. On the fifth day he is given a hot bath and allowed to get up. In the evening two pills are administered, the patient starting the decoctions again on the next day, as before. This treatment goes on in the same way until the fifteenth day, when it is discontinued.

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[1] Alfred Cooper, Practitioner, London, July, 1904.

The hot springs of Arkansas and Aachen in Germany are useful in the same class of cases, viz.: inveterate syphilis occurring in feeble individuals whose susceptibility to mercury and iodides is so extreme that they cannot be administered in sufficient doses to hold the disease under control. The water of these springs contains very little mineral substance, but has a temperature of 140° F. as it issues from the earth. Its action is to cause free secretion by the kidneys and skin, and, while it has no specific action upon the lesions of syphilis, it increases the *tolerance* of the body and enables the patient to take large doses of mercury and the iodides.

Treatment at the hot springs is unnecessary for a patient who is able to take mercury and iodide of potash in the ordinary doses, and it is only the exceptional individual who requires to be treated at one of these resorts.

The serum treatment of syphilis has, up to the present time, been entirely without success, although many attempts have been made to make an antisyphilitic serum.

The difficulties in the way are obvious: first, the pathogenic germ of syphilis has not yet been cultivated; and secondly, the immunity of all the animals, except apes, to syphilitic infection precludes their use as mediums of cultivation.

Among the recent attempts reported at making an antisyphilitic serum are those of Risso and Cipolina,[1] who injected a number of dogs with blood obtained from patients in the secondary stage of syphilis, who had never had any syphilitic treatment.

The blood of these animals was taken, and the serum was made so as to contain not only the blood-serum of the animal, but also the active principle of the corpuscles, and solid contents of the blood.

Sixteen patients were injected with the serum so prepared, and with reported improvement.

Metchnikoff's experiment may also be mentioned. He inoculated six apes (Makkaken) with syphilis, and no symptoms occurred, showing their immunity. He then took the serum from these apes and inoculated chimpanzees, and they also appeared to be rendered immune.

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[1] La Reforma Medica, November 30, 1904, and Medical Record, February 4, 1905.

The matter at present is entirely too hypothetical to be of any value, and we must still rely on the treatment with mercury and iodide of potash, which has been for generations the trustworthy and proven method of bringing a case of syphilis to a successful end.

THERAPEUTICS OF SYPHILIS.

TREATMENT OF DIFFERENT STAGES.

Primary Stage.—It is now generally held by the best authorities that it is not good practice to begin the administration of mercury in syphilis until the eruption appears upon the skin, announcing the commencement of the secondary stage. If mercury is given before this time, it has only the effect of delaying the appearance of the rash, and it may be postponed for some months, but the premature administration of mercury has no effect in aborting the disease or mitigating its severity. On the other hand, it has been noted by Ehrmann that patients who were treated with mercury for some time previous to the appearance of the eruption were more liable to tertiary affections than in the cases where treatment was not begun until the secondary period.

Another advantage which is derived from waiting till secondary manifestations appear, before beginning treatment, is that the diagnosis is fully established and the patient, being entirely convinced that he has syphilis, is more willing to carry out faithfully the details of a protracted course of treatment.

The period of waiting for secondary manifestations can be utilized by sending the patient to a dentist to have the teeth put in order. He should also be instructed as to the **hygiene** to be maintained during the course of the disease. Everything should be done to maintain the bodily health and nutrition; plenty of sleep and exercise in the open air, abundance of plain, nutritious food, and freedom from overwork or anxiety should be insisted upon.

The use of tobacco should be interdicted, as it causes an irritation of the mucous membrane of the mouth, which predisposes to the formation of mucous patches and chronic ulceration and tends to retard their healing.

Alcoholic drinks in strict moderation may be permitted in the shape of small quantities of beer or light wine, taken preferably with the meals. The habitual use of whiskey is injurious.

The patient should be instructed with regard to the danger of communicating syphilis to others, through the medium of a cup, spoon, pipe, towel or other utensil, and by means of sexual intercourse or kissing.

Mild Form of Syphilis.—As the virus of syphilis is being constantly formed and is present in the blood for months, it is necessary, in order to neutralize its effects, to keep the patient continually under the influence of mercury.

Before beginning the treatment we should wait until the eruption is well out upon the body, and as the virus is most abundant in the early stages of the disease, it is always desirable to push the administration of the mercury at first.

Indeed, the most valuable time to influence the disease is in the early months, and very few cases which are actively treated during this time ever show later manifestations.

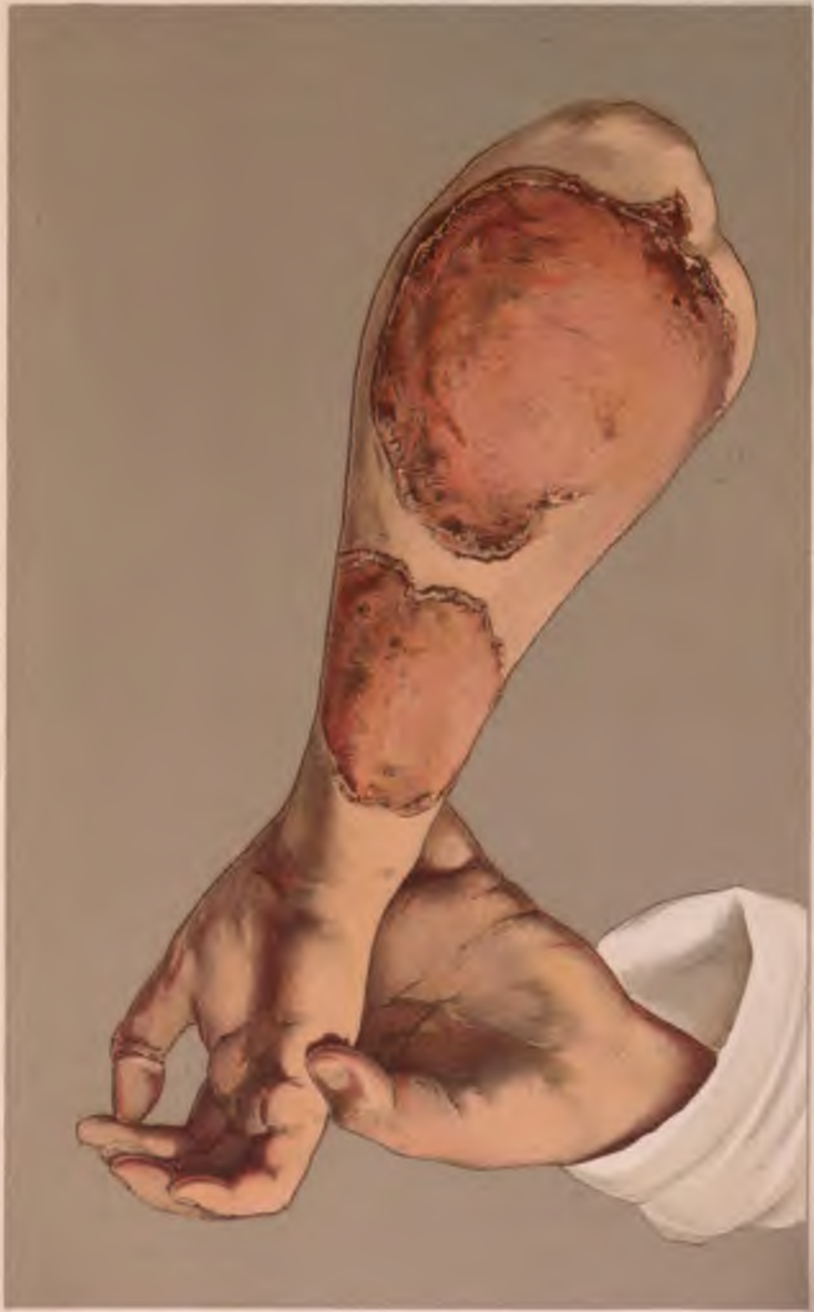
As the most efficient way of administering the mercury is by inunction, the patient should begin rubbing mercurial ointment into the skin as soon as the eruption is well developed.

After a sufficient number of inunctions have been made, usually from twenty to forty, slight ptyalism occurs, and this marks the limit to which the mercury can be pushed. All treatment is then stopped for a couple of weeks. At the end of a fortnight the patient should begin taking mercury by the mouth, and as a rule, the protiodide answers the purpose better than any of the other preparations, as it does not disagree with the stomach.

In many cases, however, after a time the intestinal canal loses its power of absorption, and the mercury is eliminated with the fæces without having passed through the blood. On this account, it is always desirable to stop the internal administration of mercury after six months, in order to allow the intestinal tract to rest.

A second course of inunctions is then made, until slight salivation occurs, and after a fortnight's rest the protiodide pills are again resumed, and continued for six months more, when a third course of inunction is made.

At the end of the first twelve months, unless some indication



appears for it earlier, the administration of **iodide of potash** is begun, and the mercury is continued in addition. A favorite and useful prescription which, although chemically incompatible, is therapeutically active, is the following for the so-called mixed treatment:—

℞ Hydrargyri bichloridi	gr. ij.
Potassii iodidi	ʒv.
Syrupus sarsaparillæ	f℥ij.
Aquæ destillatæ	q. s. ad f℥iv.

M. Sig.: ʒj t. i. d.

It is preferable, however, to give the bichloride separately, in gr. $^{1}/_{15}$ doses, three times a day, immediately after meals, in some syrup as a vehicle; the iodide of potash is best given in 30 or 40-grain doses, three times a day, in seltzer water, 2 hours after eating.

The iodide of potash has no direct action on the virus of syphilis, but it stimulates the activity of the lymphatic system, facilitates getting rid of waste-products, and also causes the absorption of any syphilitic infiltration which may have taken place in the tissues or arteries.

In a few instances it is necessary to begin administration of the iodide of potash at an earlier date, the indication for its use being the development of precocious tertiary lesions.

The iodide of potash and mercury should be continued together with an intermission every six months, during which courses of inunction should be made. At the end of two and one-half years' treatment, the patient having been on mercury alone for twelve months, and mercury and iodide of potash together eighteen months longer, the medication may be stopped.

The patient should be then kept under observation six months more, and, if no relapses occur, the syphilis may be considered at an end.

The course of treatment as outlined above is one which is largely employed in America, and which the author has used for a number of years with satisfactory results.

While in its main outlines the treatment of syphilis is the same, yet the details differ in different countries, and in the hands of different men.

In the Charitè, in Berlin, and in general throughout Germany, the following is the treatment employed:—

During the first year, three courses of inunctions are made, the first two consisting of from thirty to forty inunctions, and the third, of from twenty-four to thirty.

In the second year two courses are made, consisting of twenty-four to thirty inunctions each.

In the third year, one course is made, consisting of twenty to twenty-five inunctions. Instead of inunctions, injections are substituted when it is the patient's wish.

During the intervals between the inunctions no mercury is given by the mouth, nor is iodide of potash used, unless indicated by the occurrence of a tertiary lesion, and towards the end of the course of the disease a final series of inunctions is given, when practicable.

Whatever plan of treatment is employed, however, the general nutrition of the patient should receive the closest attention during this protracted treatment. Syphilis itself is a debilitating disease, and mercury, if administered for a long time, has the effect of causing a condition of pallor and anæmia. Of course, when such an effect is induced, the mercury should be stopped and tonics given.

Tonics are usually required at some stage of the disease, to counteract the destruction of red corpuscles caused by the virus. The anæmia is treated with iron, and the nervous system and general nutrition are stimulated with strychnia. Cod-liver oil is very valuable for the emaciation and loss of weight, and especially so if there is a complication of tuberculosis. Close attention should also be paid to the matters of fresh air, exercise, food, sleep, and freedom from anxiety.

In order to keep watch on the patient's general condition it is desirable to keep a record of his weight, and it is not a difficult matter to make frequent tests with a hæmoglobinometer, to see that the normal standard of hæmoglobin is maintained.

The urine should be examined every week, to make sure that the administration of mercury has not caused a nephritis.

A free elimination of the morbid products through the skin should be assisted by diaphoresis in a Turkish bath, without the cold plunge, a couple of times a week, except during the inunction courses.

The treatment of an ordinary case may be tabulated as follows:—

Primary Stage.—Local treatment of chancre: calomel, iodoform, mercurial plaster. Tonics, care of teeth, and general hygiene.

Secondary Stage.—Begin with mercurial inunctions until mild salivation is induced, subsequently protiodide of mercury by mouth for six months. Discontinue, and give second course of inunctions, followed by protiodide for six months. Third course of inunctions.

Tertiary Stage.—Iodide of potash in combination with mercury for following eighteen months. At the end of every six months internal treatment discontinued and mercurial inunctions made.

At the end of two and one-half years all treatment is discontinued and patient is kept under observation for six months longer.

Severe Form of Syphilis.—The severe cases of syphilis and malignant syphilis cannot be treated in any routine way, but each case must be handled with reference to its own peculiarities. We can say, in a general way, that it is necessary to get the patient promptly under the influence of mercury, and at the same time avoid disturbing the digestion; and the hygienic treatment—consisting of good food, good hygienic surroundings, sunlight, fresh air, and tonics—is imperatively demanded in these cases.

The best method of using mercury is by inunction, and next in value may be ranked the hypodermic injections. The disadvantages of giving mercury by the mouth are that it acts more slowly, and is very apt to disturb the digestion. After the disease is under control the mercury may be given by the mouth, but inunctions should be used a couple of times a year.

In this class of cases it is necessary to begin the administration of *iodide of potash* earlier than at the beginning of the second year, inasmuch as tertiary lesions or gummata are apt to occur precociously, even as early as the fifth or sixth month, and the iodide generally has to be used in larger doses.

After the syphilis has run a severe course for a few months a condition is induced which is known as the **cachexia of syphilis**, and which is characterized by extreme debility and vital depression, which have resulted in consequence of the anæmia and emaciation.

If severe spreading lesions exist upon the skin and mucous membranes, the case may be properly termed *malignant syphilis*. These patients unfortunately do not bear mercury and the iodide well, and in these conditions such tonic remedies as Zittmann's decoction and the hot springs of Arkansas are to be recommended.

Grave tertiary lesions of the viscera or nervous system are liable to follow a mild attack as well as a severe one, and of course the outlook for ultimate recovery depends largely upon the general character of the patient's constitution.

With individuals of fair bodily health, in the presence of a gumma of the brain or viscera, or of endarteritis of the arteries supplying the nervous system, or indeed any of the manifold complications of the tertiary period, the dosage of the iodide should be increased rapidly up to ½ ounce, or even 1 ounce, in the day, the only rule for the quantity given being the effect produced.

The patient should be put to bed and fed on a diet consisting of milk, eggs, and broths. Mercury should be given by *inunction* until a mild ptyalism is induced, and at the same time iodide of potash should be administered in saturated solution.

In cases of cerebral endarteritis, Browning advises nitroglycerine to cause dilatation of the arteries in the brain and improvement in the circulation.

LOCAL TREATMENT OF LESIONS.

It has been found that the direct contact of a mercurial preparation with a local syphilitic lesion hastens its disappearance by absorption. An advantage is sometimes taken of this fact by using fumigation or bichloride baths, in addition to the regular general treatment, to accelerate the healing of extensive, wide-spread, ulcerating lesions of the skin.

The papular eruptions on the face are annoying and unsightly, and can be made to clear up more quickly by rubbing in an ointment of the white precipitate of mercury; or mercurial plaster may be laid over the spots. They should be always treated, because if they are neglected they are apt to leave a pigmentation upon the former site.

Mucous Patches.—If mucous patches exist in the mouth, they are always of danger to innocent people, since their secretions may be conveyed upon some utensil and be inoculated into another person. On this account we should endeavor to heal them as quickly as possible. In addition to the frequent use, by the patient, of a mouth-wash of chlorate of potash or calomel and lime-water, the patches themselves should be brushed over once a day with a 1-per-cent. solution of corrosive sublimate.

The acid nitrate of mercury, in the strength of 1 part to 10 or 20 of water, is also an excellent preparation to use, and it also acts brilliantly in clearing up ulcerating and infiltrated patches which often occur on the tongue in late syphilis. (Sherwell.)

Condylomata heal readily under the general mercurial treatment, and it is only necessary to keep them clean; cover them with a dusting powder, which absorbs their secretions; and prevent contact with other parts and chafing by means of absorbent cotton interposed.

Another very convenient way of treating them is by a mixture of calomel with salt solution. This makes a thick paste, with which the condylomata can be covered.

Frambœsia of the scalp, the so-called macaroon syphilide, may be treated by using an application of the following:

℞ Alum.
Powd. camphor.
Plumbi carbonat .... aa parts 2
Hydrarg. bichlor.................................. parts 4
Spts. vini diluti,
Acidi acetici pura.............................. aa parts 45

M. Pour off the supernatant fluid.

The thick, pasty fluid at the bottom is to be brushed on the lesions.

Ulcerating Gummata.—When the floor of a gummatous ulcer is the seat of granulations, the curette should be freely used, to cut them away; or if the membrane is necrotic, it may be encouraged to slough off under poultices or gauze compresses wet with liquor ammonii acetatis.

The healthy granulating surface may afterwards be covered with iodoform gauze; or Taylor advises a mild mercurial ointment with balsam Peru ʒi to the ounce. An active internal medication must also be followed.

After the lesions are dry and infiltrated, mercurial plaster should be used as a local application.

IMPOTENCE AND STERILITY.

CHAPTER XXIV.

IMPOTENCE.

Impotence may be defined as an inability on the part of the male to copulate, either on account of a failure of the penis to become erect, or because the ejaculation of seminal fluid takes place prematurely and before the penis has entered the vagina or else does not occur at all.

The mechanism of copulation is a complicated one, and requires for its performance the co-ordinated working of both nervous and muscular systems. The function of erection is known to be under the control of a collection of nervous ganglia, situated in the lumbar enlargement of the spinal cord, which is called the **centre of erection.** The centre of erection receives nerve-filaments from the genital centre in the brain, and it also receives sensory fibres from the rectum, bladder, and genitals. It also sends out nerves, the *nervi erigentes,* to the genitals, whose function is to cause a vasomotor paresis of the blood-vessels in the corpora cavernosa.

A knowledge of the distribution of these various nerves serves to explain the following facts: An erection may be provoked by the influence of the brain, if it entertains libidinous ideas, or an *inhibitory influence* may be exerted from the brain by the mental emotions of fear, disgust, or fright (psychical impotence), and vigorous mental activity has the effect of removing, for the time being, sexual desire.

Certain forms of irritation of the spinal cord, caused by myelitis, traumatism, or fracture-dislocation, when the lesion is located in the cervical or upper dorsal region, are often attended with persistent and powerful erections of the penis.

Erections are also caused by peripheral irritation from the genitals, transmitted along the nerves leading to the centre of erection in the cord. At this point, as a result of irritation of the genitals, the sensory impulse is converted into a motor one and reflected back again to the genitals along the *nervi erigentes.*

As common illustrations of erections from peripheral irritation may be mentioned the erections occasioned by a bladder filled with urine in the morning, prostatic enlargement, or the passage of a sound through the deep urethra.

MECHANISM OF ERECTION.

The mechanism of erection is as follows: Under the influence of the nervi erigentes a relaxation of the vascular spaces in the corpora cavernosa takes place, and they fill with blood. The penis becomes erect, hard, and elongated, because the blood is pumped into the spaces and retained there.

If the blood flowed out of the erectile tissue as fast as it came in, erection could not occur; but the swelling of the corpora cavernosa exerts a certain degree of pressure upon the veins which ordinarily conduct the outflowing blood away from the penis. The return-flow of blood is checked by the pressure on the veins, and it is retained in the spaces of the erectile tissue of the penis.

Unless the spaces of the erectile tissue be completely relaxed, a sufficient quantity of blood cannot enter them to exert pressure on the outgoing veins, and the blood flows away through them.

MECHANISM OF EJACULATION.

In a normal condition ejaculation only occurs with a fully erect penis, except during sleep.

As the spaces of the corpora cavernosa become filled with blood, the verumontanum, or caput gallinaginis, which is composed of erectile tissue, also swells and becomes erect, thus blocking the entrance to the bladder, so that urine cannot flow out.

The urethral glands secrete freely and a viscid clear drop of mucus appears at the orifice of the urethra. The object of the secretion is to cover the urethral walls bathed in acid urine and to prepare them for the reception of the semen.

The contents of the seminal vesicles are poured out through the ejaculatory ducts, until the posterior and bulbous dilatations of the urethra become filled with semen, and after these are distended contractions of the bulbo-cavernosus muscles occur, and the semen is ejaculated in jets from the meatus. If the force of the muscles is impaired, as in paralytic impotence, the semen is not shot out in jets, but dribbles slowly away from the meatus.

CLASSIFICATION OF FORMS OF IMPOTENCE.

I. Organic, from mechanical defects.

II. Psychical, or imaginary: 1. Complete. 2. Relative.

III. Atonic, from exhaustion of genital centres in brain and spinal cord.

IV. Symptomatic: Variety A. Irritable Impotence, from disease in urethra or adnexa. Variety B. Paralytic Impotence, from organic disease in nervous system. Variety C. Impotence due to Drugs.

ORGANIC IMPOTENCE.

In this form of impotence some physical cause, which is either congenital or acquired, renders coitus mechanically impossible. The obstacle may prevent the introduction of the penis into the vagina, or, in the absence of a urethra, while coitus can be performed, it is not possible to inject the semen into the vagina.

Among the causes of organic impotence may be mentioned such failures of development as hypospadias, epispadias, small size of the organ; or acquired deformities (such as elephantiasis and tumors), disease of the corpora cavernosa (such as syphilitic or fibroid induration), or partial destruction following wounds, and cavernitis are sometimes responsible for interference with coitus, and operate by causing a deviation or curve in the penis upon erection.

Swellings of the surrounding parts, such as hernia, scrotal tumors, or excessive corpulence, with an overhanging belly, may render insertion of the penis impossible, but the sexual desire is strong, and ejaculation occurs.

TREATMENT.

In organic impotence the treatment will be successful in so far as it is possible to remove the mechanical obstacle to copulation.

In hypospadias and epispadias a plastic operation can be performed, and, when the penis is completely inclosed by overlying tissues, a small, freely-movable penis capable of intromission may be formed.

Tumors and elephantiasic growths must be removed by surgical means, and hernia and hydrocele also call for operation. An effort should be made to bring about absorption of the infiltration in the corpus spongiosum, which may be confidently expected to occur if it is syphilitic in origin.

PSYCHICAL IMPOTENCE.

We have already noted in studying the physiology of coitus, the fact that the brain is capable of exerting a restraining influence over the power of erection, through the inhibitory nerves which go to the spinal centre of erection. As a result of nervous excitement, the action of the inhibitory nerves from the brain is aggravated, and erection fails at the critical moment. The influence of fear and dread are observed in the same class of patients before passing a sound.

When these individuals are lying on the table, the penis is seen to shrink and grow smaller and move in a worm-like manner, which is caused by the spasmodic contraction of the muscular fibres imbedded in the trabeculæ of the corpora cavernosa. In such cases the inhibitory nerves are stimulated by the dread of catheterism, in the same way other psychical influences stimulate the action of the inhibitory nerves, and the patient is at such moments impotent.

Various types of men are affected by the form of psychical or imaginary impotence, as follows:—

Class A.—A few strong, young, vigorous men who have led clean lives, on being married to the women of their choice, either from a state of nervous excitement or a lack of confidence in themselves, or perhaps occasionally from timidity and bashfulness, do not succeed in holding an erection long enough to perform coitus, and the erection either fails to be complete or else ejaculation occurs prematurely.

Class B.—Feeble, despondent, oversensitive individuals of weak, nervous fibre, who have masturbated, had an attack of gonorrhœa, or have been excessive in sexual intercourse. Such persons are continually dwelling on past abuse and worrying over trifling symptoms, such as a varicocele or the normal weekly occurrence of a seminal emission, and their fears are aggravated by reading quack books.

Class C.—Men of good health and well-balanced minds may be affected by various mental emotions, such as fear, disgust, and loathing, or the departure from regular habit, all of which may induce temporary impotence.

It is no uncommon experience, when illicit intercourse is being attempted, that a fear of exposure or infection, or of disgust at some coarse remark on the part of the woman, causes a failure or sudden subsidence of the erection.

The effect of habit is seen in the cases where a man is accustomed to cohabit successfully with one woman, but fails to accomplish the act of coitus with a stranger, until he becomes accustomed to the new fields. Roubaud's case is cited as an example of this. A young man who was accustomed from the beginning of his sexual life to a certain type of woman, who was a blonde and always met him dressed in a silk gown and with shoes on, could never have coitus with any other woman, unless she were also a blonde and dressed in a similar manner.

Severe and prolonged mental strain, such as occurs with students, business and professional men, sometimes brings about a condition of general neurasthenia, one of the symptoms of which is temporary impotence.

Relative impotence is a form of psychical impotence, and is the term applied to a condition in which the man is able to copulate with certain women only, and not with others.

When this is the case between man and wife, it may be due to a mutual aversion or a lack of sexual feeling on the part of the wife, which reacts upon the man and takes away his desire, and yet the same man may be entirely potent with other women.

TREATMENT.

Before beginning treatment, it is essential to make sure that we are dealing with a case of true psychical impotence and that the impotence is not *symptomatic* of some lesion in the urethra or nervous system.

The psychical form disappears spontaneously when the mental disturbances occasioning it vanish. For instance, the death of a beloved wife or loss of fortune and business anxieties may cause temporary impotence, which disappears as time goes by or the individual's circumstances improve. In these cases the friendly advice of a physician in whom the patient has confidence is valuable.

The largest number of cases of psychical impotence occur in nervous young men who have had gonorrhœa or masturbated freely, and who have read and pondered over the false and lurid accounts in quack medical advertisements, pretending to describe the evil consequences of masturbation or sexual excesses.

ATONIC IMPOTENCE.

The term atonic impotence has been rather loosely used by authors, and has been incorrectly made to include cases which were dependent upon lesions of the urethra or spinal cord or the abuse of drugs, and should have been properly classed under the head of symptomatic impotence.

Atonic impotence is a variety of comparatively rare occurrence, and in which there is no demonstrable lesion of the nervous system or urethra. It is purely functional in character, and is dependent entirely upon a failure of the spinal centre of erection, and perhaps the genital centre in the brain, to respond to ordinary stimuli and cause the penis to become erect.

It should be borne in mind, however, that a condition of exhaustion of the nerve-centres is often complicated by chronic inflammatory changes in the posterior urethra, induced by a gonorrhœa of long standing or sexual abuses, and this fact should not be lost sight of in carrying out the treatment. Here, again, advice and the assurances of the physician, in combination with attention to building up the general health by salt-water bathing, out-of-door exercise, boating, golf, and moderate walking or light gymnastic exercises, is the basis of treatment.

Hypnotism may be successful in relieving this form of impotence, but as our knowledge of influencing the mental powers in this way becomes more extended, the danger of inducing the hypnotic state and other drawbacks becomes more obvious; so that, in general, it is not desirable to employ this form of treatment.

In atonic impotence sexual desire is often present, but frequently it is absent, and, as a rule, erections do not occur at all. Sometimes, however, in mild cases, a partial erection, accompanied by premature ejaculation of semen, takes place.

The atonic form of impotence is exclusively found in married men who have practiced coitus excessively or "withdrawal" with their wives for years, excessive masturbators, and old *roués* whose only thought in life has been the gratification of their sexual desires.

The lack of erectile power is usually only one symptom of general neurasthenia, which is accompanied by its usual signs, viz.: mental symptoms such as impairment of memory, fullness in the head, and anxiety; pains in the back and limbs, feeble heart-action, vasomotor disturbances, indigestion, constipation, etc.

These general symptoms have been described by quacks in terrifying terms, in pamphlets pretending to set forth the "evil effects of self-abuse," which have an extensive circulation among the laity.

Authorities are now generally agreed that, aside from a degradation of the moral character of the individual, masturbation, practiced occasionally, exercises but little bad effect upon the general health, and its effects cease as soon as the habit is stopped, unless a condition of chronic inflammation is induced in the posterior urethra, and the same is true of *coitus reservatus,* or withdrawal.

If, however, masturbation or withdrawal is practiced at frequent intervals and for a long period of time, chronic posterior urethritis occurs, which gives rise to various local symptoms and is often complicated by a general neurasthenic state (see "Chronic Posterior Urethritis").

DIAGNOSIS AND TREATMENT.

Before making a diagnosis of atonic impotence care should be taken to exclude any disease of the urethra and its adnexa or the nervous system. It is generally the case that, with old rounders and masturbators, a stricture, chronic urethritis, prostatitis, seminal vesiculitis, or beginning spinal disease is present, and the impotence is not atonic and caused by exhaustion of the nervous centres, but is secondary to and a symptom of the local structural change in urethra or spinal cord.

When all these local conditions have been excluded, however, and we are certain that we are dealing with a pure functional neurosis, the following lines of treatment may be employed:—

The indications are to build up the general health of the patient, and at the same time give complete rest to the genital centres in the brain and cord; so that their cells may have an opportunity to store up again a renewed quantity of nervous energy.

Later on, after a sufficiently long period of rest has been enjoyed, a plan of treatment should be adopted, calculated to stimulate and arouse again to activity the dormant cells in the genital centres; but this should never be attempted until a sufficient period of complete repose has been afforded them.

The neurasthenia, which is usually present, requires the first attention, and the patient should be directed to make use of a light, easily-assimilated diet, get plenty of sleep, and take gentle, regular exercise in the open air.

Riding on horseback and the bicycle is not to be recommended, on account of the jarring to which the perineum is subjected when these are indulged in. Sea-bathing has an excellent effect as a general tonic.

Especial stress should be laid upon the necessity for avoiding all sources of erotic excitement, such as lewd books, conversations, and theatrical diplays; companionship of women, immoral or otherwise, and all attempts at sexual intercourse must be rigorously interdicted.

In the early stages of treatment, in addition to blood- and tissue-building tonics,—such as cod-liver oil and iron,—the spinal sedatives—bromide of potash and lupulin—are in order for the purpose of giving the necessary rest to the exhausted centres.

After this treatment has been continued for some weeks and the patient's neurasthenia has disappeared, it sometimes happens that his sexual functions are improved as well; but frequently the irritability of the genital centre is still so exhausted that erections either do not occur at all or are not sufficiently vigorous, and ejaculation is premature; so that a special stimulating plan of treatment has to be adopted to arouse the activity of the cells in the genital centres.

The drugs which are supposed to be particularly useful as stimulants to the nervous centres are phosphorus and nux vomica. They may be combined in the following manner, as suggested by Gross:—

℞ Quiniæ sulphatis,	
Ferri sulphatis ....of each	gr. xl.
Zinci phosphidi	gr. ij.
Acidi arsenosi	gr. iss.
Strychniæ sulphatis	gr. $^2/_3$.

M. et ft. pil. No. xl.

Sig.: Two pills every eight hours.

Damiana and cantharides have gained some reputation among the laity as aphrodisiacs, but damiana has little or no effect, and cantharides acts as an irritant upon the kidneys and bladder whenever taken in doses sufficiently large to act as a genital excitant.

Yohimbin, which is an alkaloid, in moderate doses (gr. $^1/_{10}$ t. i. d.) is said to cause prompt appearance of erections, in cases of impotence, by producing dilatation of the blood-vessels in the genital organs.

In excessive doses it may cause hallucinations, hyperæmia of the skin and mucous membranes, as well as the genitals. Its action as an aphrodisiac is inconstant and often disappointing.

It was hoped that when the animal extracts were first introduced, they might prove of value, but extended trials of them have only resulted in disappointment.

Electricity enjoys a high reputation in the treatment of atonic impotence. The constant current is adapted to most cases, beginning with the positive pole applied over the lumbar region and the negative pole used to stroke the penis, testicles, and perineum. The strength of the current may be gauged by the sensitiveness of the patient, and it should not be used strong enough to cause discomfort. The sittings at first should be for two or three minutes every forty-eight hours, and soon increased to five minutes daily. In obstinate cases, if erections do not occur from these applications, the positive electrode may be introduced into the rectum and a more powerful effect excited. In cases where marked anæsthesia of the skin of the genitals exists, the faradic current may be used, with better results than the galvanic.

Cold douches, or the alternate use of cold- and hot- water douches, applied with some force to the spine daily, are of some assistance, and in the same way irrigation of the rectum with hot water through a Kemp tube may be of some service as a local stimulant to the prostatic urethra.

Local treatment of the urethra is, of course, demanded when atonic impotence is complicated by chronic inflammation of the posterior urethra (see "Symptomatic Impotence"); but, in cases where the posterior urethra is healthy and the difficulty is a pure neurosis, the passage of sounds and use of instillations generally increase the neurasthenia, and the patient is made worse.

The operation of ligation of the dorsal vein of the penis has been practiced, with the object of retarding the return-flow of blood, and so allowing the erectile tissue of the corpora cavernosa to become distended and filled up with blood, in the cases where a partial erection occurred, but where the penis almost immediately became flaccid without any discharge of semen. A few cases have been reported where this operation proved successful, but the mental effect of an operation may have been partly responsible for the good result.

After the condition of impotence has yielded to protracted and careful treatment, and the patient is again able to have erections and ejaculate normally, he should be warned against indulging too freely in sexual intercourse, for any excess in this line will be very apt to be followed by a recurrence of his former disability.

SYMPTOMATIC IMPOTENCE.

This is by far the most frequent type of impotence met with in practice. The disability is never primary, as in the other forms, but it is always dependent upon and secondary to certain structural pathological changes, located in the nervous system or the urethra and its adnexa, and the inability to copulate is only one symptom of many which go to make up the clinical picture.

In symptomatic impotence erections may be completely absent, although, as the genital centres in the nervous system are not affected, sexual desire is usually present.

In many cases a partial erection of the penis takes place, and the seminal fluid is ejaculated prematurely. This form is generally spoken of as

VARIETY A. IRRITABLE IMPOTENCE.

This term is derived from the fact that, on account of the irritable state of the posterior urethra, the ejaculation of semen occurs prematurely before the penis has penetrated into the vagina, and the organ, which never attained to a complete erection, becomes flaccid immediately after the discharge. Many of these cases, which are characterized at first by premature ejaculation, grow worse, and in time the power of erection disappears entirely.

Irritable impotence generally depends upon the presence of chronic posterior urethritis, and the inflammation often extends from the urethra through the ejaculatory ducts, and the prostate and seminal vesicles become affected also.

Chronic posterior urethritis originates from a gonorrhœa or from sexual excesses, masturbation, or the pernicious habit of interrupted coitus, or "withdrawal."

These causes are liable to induce a condition of chronic engorgement of the blood-vessels in the posterior urethra. In course of time hyperplasia of the submucous connective tissue occurs, and the newly-formed scar-tissue, pressing upon the delicate nervous structures of the verumontanum, occasions various reflex symptoms in the brain, nervous and muscular systems. The process is often further complicated by germ-infection, often the bacillus coli, which aggravates the existing conditions.

Instead of a chronic posterior urethritis being responsible for the reflex disturbances, an organized stricture may be present in the pendulous urethra, and if the stricture be located in the deeper portion of the canal, it interferes so much with the circulation of blood in the posterior urethra that a chronic congestion results, which disappears promptly when the stricture is treated.

TREATMENT.

To treat the symptom of irritable impotence successfully, the condition in the posterior urethra requires attention. (See "Chronic Posterior Urethritis," "Prostatitis," and "Seminal Vesiculitis.") The discharge of pus, if present, should be controlled by irrigations, and later, when shreds alone are found floating in clear urine, instillations of nitrate of silver in the posterior urethra are called for.

The submucous infiltration can be favorably influenced by the passage of large-sized sounds. An instrument of particular efficacy in reducing the irritability of the posterior urethra is the *psychrophor,* which combines the benefits of pressure with the effects of cold in blunting the hypersensitiveness of the nervous system.

If the prostate or vesicles are diseased, massage and expression of their contents, by means of the finger in the rectum, are required to bring about a resolution of those affected organs, and if a stricture is present, it must receive appropriate treatment, either by dilatation or cutting.

The prognosis of irritable impotence is good, in so far as we can succeed in removing the cause upon which the impotence depends.

VARIETY B. PARALYTIC IMPOTENCE.

In paralytic impotence erections do not take place at any time, although half-erections sometimes occur. Ejaculation does not occur at all, or else takes place without causing any sensation, and the semen is not ejected in jets, but gradually oozes from the meatus.

On examination the genitals are found withered and flaccid, and the skin of the penis is but slightly sensitive, often quite anæsthetic. The sensitiveness of the urethra is diminished, and a sound may be pased with ease and without pain.

Paralytic impotence, as its name implies, is dependent upon organic cerebral or spinal disease, which causes paralysis in other parts of the body. Blows upon the back of the head are especially liable to be followed by complete impotence.

In locomotor ataxia in the early stages, there may be a condition of priapism; but, as the case progresses, the sexual powers decline, until finally the patient may be completely impotent. Myelitis in mild forms does not affect the sexual powers, but in severe forms a state of impotence is induced.

The prognosis in paralytic impotence is, of course, bad, and treatment, either local or general, is of little or no use.

VARIETY C. IMPOTENCE RESULTING FROM DRUGS.

Sexual power is sometimes diminished or entirely destroyed from the excessive use of certain drugs. Individuals who are addicted to the habitual and excessive use of opium, chloral, bromide of potash, and hashish are very apt, in time, to lose sexual inclination and power to copulate. Workmen who are exposed to the exhalations of certain chemicals—such as arsenic, antimony, and lead—are affected in the same way.

The influence of an excessive quantity of alcohol in reducing sexual power is a matter of common knowledge, but we are not so certain as to the effects of tobacco, although some authorities claim that tobacco has an effect in lessening both sexual inclination and capacity.

An excess of sugar in the blood, which occurs in diabetes, also causes impotence, although the individual's health and strength are apparently not deteriorated.

The **treatment** of impotence resulting from the use of drugs consists, of course, in removing the cause, and when this can be done the prognosis is, in general, favorable.

STERILITY.

Until recent years a condition of sterility was always thought to be due to some pathological condition on the part of the woman, which prevented conception. It is now recognized that in a small numbers of cases, although the man is capable of performing the sexual act, still his semen is destitute of the fecundating element, and he is sterile.

As an example of this state may be cited the case of men who have been castrated. After this operation the subjects do not become impotent at once, but for a year or two after the testicles have been removed, are able to practice copulation and ejaculate a material composed of urethral mucus and secretions from Cowper's and the prostate glands, but devoid of spermatozoa, and hence incapable of impregnating the female.

The composition of normal semen, after ejaculation, is found to consist of spermatozoa formed in the testicles and the secretions of the seminal vesicles, prostate, Cowper's glands and the glands of the urethral mucous membrane, viz.: Morgagni's crypts and Littré's glands.

The usual quantity of semen ejaculated at one discharge is from ʒii-iv but, if coitus is repeated frequently, the quantity becomes smaller each time, until finally only a few drops are produced with difficulty.

The essential life-giving element in semen is, of course, the spermatozoa, and the function of the other ingredients is probably to coat the urethral mucous membrane and dilute the semen.

On microscopic examination the spermatozoa present a most strinking picture, showing numerous small, tadpole-shaped bodies moving actively in the field. They continue to show movements until at least twelve hours after evacuation, and will present signs of activity for forty-eight hours if sheltered from light and cold.

The semen also contains *spermatic cells*, which are supposed to be breeding-places for the spermatozoa, one of which, according to Kölliker, develops out of each nucleus of a cell. *Böttcher's* crystals are discovered on adding a few drops of 1-per-cent solution of phosphate of ammonia, and appear as variegated groups of dagger-shaped crystals. It is supposed that the organic base of the crystals exists in the secretion of the prostatic follicles, and gives the semen its characteristic odor.

Finger classifies the pathological changes in the semen which cause sterility as follows:—

I. Azoöspermia, or absence of spermatozoa.

II. Oligozoöspermia, or a marked diminution in the number of spermatozoa.

III. Necrospermia: The spermatozoa are dead and without motion.

IV. Aspermia, entire absence of semen: 1. Absolute. 2. Temporary.

I. AZOÖSPERMIA.

In this condition there is an entire absence of spermatozoa. The physical character of the semen is not distinguishable from normal; the odor, consistence, and color are unchanged; and the absence of spermatozoa can only be detected by the microscope.

Azoöspermia is, of course, the normal condition before puberty, but it is rarely found in old men, who usually are able to form a few spermatozoa.

The pathological causes which bring about this condition may be grouped as follows:—

(a) **Frequent seminal emissions,** either from excessive masturbation or too frequent coitus cause first a diminution in number, and, if persisted in, a complete disappearance of spermatozoa, which reappear in the semen again after a few days' rest.

(b) **Disturbance of the Secreting Function of the Testicle.**—This generally occurs in the acute fevers and the debility following convalescence, and, as a result, the spermatozoa disappear temporarily from the semen. In chronic diseases the same often occurs, and azoöspermia often exists in tuberculosis and in syphilis, even when the testicles are not affected.

(c) **Disease of the testicle,** caused by syphilis, tuberculosis, or malignant disease, if it is bilateral and destroys completely the parenchyma of the organ, interferes with the formation of spermatozoa and leads to sterility. It is necessary, however, that it should be a complete destruction, for if a small part of the secreting portion is left, spermatozoa may still be formed.

(d) Absence of both testicles—either from removal by castration, atrophy consecutive to orchitis, congenital absence, or atrophy following ectopia testis—will, of course, induce permanent and irremediable sterility.

(e) Bilateral obstruction of the vas deferens is the commonest cause of azoöspermia, and results from epididymitis, which in 90 per cent. of the cases is due to gonorrhœa. Tuberculosis and syphilis are responsible for the remaining 10 per cent. The obliteration of the vas deferens is caused by the pressure, upon the seminiferous tubes, of a mass of inflammatory scar-tissue in the tail of the epididymis, which contracts and squeezes the tubes together. Finger cites 242 cases of double epididymitis, out of which 207 suffered from azoöspermia.

(f) Exposure to X-Rays.—F. Tilden Brown reports[1] that men by their mere presence in an x-ray atmosphere, incidental to radiography or the therapeutic uses of the rays, after a period of time—as yet undetermined—will be rendered sterile. Ten individuals who have devoted more or less time to the work during the past three years—none of whom have had any venereal disease or traumatism involving the genital tract—have been found to be the subjects of absolute azoöspermia. None of the number are conscious, however, of any change or deterioration in regard to their potency.

The treatment of azoöspermia seldom meets with much success, except in cases of syphilitic epididymitis. Here an energetic course of antisyphilitic medication will often cause absorption of the infiltration, and the testicle resumes its function.

In gonorrhœal epididymitis the infiltration is hard and dense, and after it has existed some little time it is impossible to bring about its absorption. It is important, for this reason, to treat every case of gonorrhœal epididymitis carefully, in order to avoid the danger of sterility (see "Epididymitis").

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[1] Medical News, January 28, 1905.

II. OLIGOZOÖSPERMIA.

This condition consists in a marked diminution of the number of the spermatozoa, and may, in general, be regarded as a temporary condition, which, depending upon its cause, either returns to the normal state or goes over into complete absence of spermatozoa (azoöspermia).

Oligozoöspermia occurs normally in old age and at the beginning of puberty, and it also occurs in general debility from any disease and also after repeated acts of sexual intercourse. The most usual causes for it are gonorrhœal epididymitis or new growths—either syphilis, tuberculosis, or cancer—which involve the epididymis.

As long as the vasa deferentia are not completely closed by the inflammation, a few spermatozoa may make their way through the canal. If the spermatozoa are diminished in number, and at the same time motionless, sterility is assured; but if the spermatozoa retain their movement, there is always procreative power left, but in a lessened degree.

III. NECROSPERMIA.

In this condition the male is able to copulate and to ejaculate semen, but on microscopic examination the spermatozoa are found to be dead and without motion. In order to make a valid test, it is necessary to examine the semen not later than one to two hours after ejaculation, and the specimens can only be secured by directing the man to have coitus while wearing a condom.

Necrospermia is brought about by a variety of causes which diminish the secreting capacity of the testicle. Excesses in venery or unduly frequent seminal emissions operate in this way. At first the semen is normal, but in time it becomes thinner, the numbers and motility of the spermatozoa diminish, they become small, deformed, and unripe.

The same effect is produced upon the spermatozoa by a disturbance in the nutrition of the testicle from alcoholism, morphinism, general tuberculosis, or diabetes. Various local processes—such as syphilis, carcinoma, and beginning atrophy—exert their effect upon the parenchyma of the gland, and the formation of spermatozoa is affected in consequence.

A more frequent cause of the death of the spermatozoa is some pathological alteration of the component parts of the semen. Inflammation of the seminal vesicles, either acute or chronic, causes perceptible alteration in the semen. It is usually purulent and sometimes bloody, deriving its foreign constituents from the inflamed cavities of the vesicles, and the spermatozoa are found to be dead.

The spermatozoa are also motionless in cases of chronic follicular prostatitis, for as Fürbringer has demonstrated, the spermatozoa, so long as they are retained in the seminal vesicles, are motionless, and it requires the contact of the prostatic secretion to arouse their normal motility. When the prostatic follicles are diseased, their secretion is checked, and the spermatozoa are deprived of the stimulant necessary to excite their activity.

As already indicated, the treatment of necrospermia will depend upon the cause which occasions it, and the prognosis is good or otherwise as we are able to remove its origin.

IV. ASPERMIA.

Aspermia may be defined as a condition in which the male is able to perform coitus properly, but no semen is ejaculated into the vagina of the female, either because none is secreted or because some obstruction in the urethra prevents its passing from the meatus.

Aspermia may be either absolute or temporary, congenital or acquired.

Congenital aspermia is a very rare condition, but a few cases have been reported. Ultzmann assumed it to be due to a non-excitability of the reflex centre of ejaculation. Jacobson suggests that, while the testicles are present and capable of forming spermatozoa, they cannot make their way into the urethra on account of an occlusion of the ejaculatory ducts or an absence, from anomaly of development, of a portion of the vas deferens.

Acquired aspermia is not uncommon, and is often the result of suppurative affections of the prostate brought about by gonorrhœa or tuberculosis. Through the destruction of the gland and the subsequent formation of scar-tissue, the ejaculatory ducts are closed by the contraction of the cicatrix. If one duct is left open, the semen is diminished in quantity, but not noticeably so; if both ducts are closed, aspermia follows.

The ejaculatory ducts are also occasionally destroyed during a lateral lithotomy, either by being cut, in incising the posterior urethra, or by suffering laceration in dragging a large stone out of the bladder and through the wound.

The ejaculatory ducts sometimes become plugged by the formation of concretions, composed of spermatozoa, mucus, epithelial cells and lime-salts.

An insensitive condition of the glans penis may be responsible for the failure of ejaculation, and cases have been reported where an injury to the spine caused a complete anæsthesia of the skin of the genitals. In another case on record the prepuce and dorsum of the penis had been destroyed by ulceration and converted into a large indurated scar, which was entirely insensitive.

One of the most frequent causes of aspermia is stricture of the urethra. On account of the swollen and turgid condition of the mucous membrane of the urethra during coitus, the orifice of a tight stricture is closed, and the seminal fluid is unable to escape past it, but is retained in the urethra behind the stricture. After the congestion subsides the verumontanum no longer closes the vesical outlet, and the semen regurgitates into the bladder, and is subsequently discharged with the urine.

Temporary aspermia is a rare condition which occurs in persons of a nervous temperament who become neurasthenic from excesses in venery, masturbation, or gonorrhœa. Such individuals are usually impotent (psychical impotence), but occasionally such patients are found who can copulate, but cannot ejaculate any semen at the time, although the seminal fluid may escape a few hours later during sleep, as an emission. This form of aspermia begins suddenly, lasts a few weeks or months, and then vanishes as suddenly as it came.

The treatment of aspermia in its various forms depends upon the etiology, but the variety depending upon stricture offers a good prognosis when the urethra is restored to its normal calibre.

LIST OF GENITO-URINARY INSTRUMENTS REQUIRED FOR OFFICE USE.

Valentine's irrigator.

Ultzmann's syringe.

Large metal and glass syringe, capacity 4 to 6 ozs.

Kollmann-Frank irrigating dilator for the anterior urethra.

Kollmann-Frank irrigating dilator for the posterior urethra.

Kollmann's straight dilator for the anterior urethra.

Ultzmann's brush apparatus.

Otis urethrometer.

Eighteen steel sounds, Van Buren curve. Number 16 to 34 French, inclusive, but omitting every other number.

Guyon sounds, 16 to 34 inclusive, omitting every other number.

Tunneled sounds, numbers 12, 14, 16, 18, and 20 French.

Psychrophor with Benique curve; attached to four-quart douche-bag.

Bougies à boule, metal; numbers 16 to 32 inclusive, omitting every other number.

Guyon's flexible gum-elastic bougies à boule, 16 to 30 French, omitting every other number.

One dozen whalebone guides.

Thompson's searcher for stone.

Nitze's observation cystoscope.

Bierhoff-Frank double-barreled cystoscope for catheterizing ureters, or

Cabot's or Brown's straight cystoscope for catheterizing ureters.

Harris's or Luy's segregator.

Urethroscope with light-carrier.

Four tubes, 24, 26, 28, and 30 French.

Dry-cell battery, or transformer for street current.

Electrodes, rectal and urethral.

Needle for electrolysis of Morgagni's crypts.

Long urethral forceps.

Hypodermic syringe for injecting mercurial salts.

Catheters: Soft rubber. Silver, with prostatic curve. Woven silk coudé and bicoudé (prostatic). One Gouley tunneled silver catheter, English, with stylet.

Flexible bougies, from number 18 down to smallest.

Microscope, oil immersion, stains, etc.

APPENDIX.

The importance of the microscope in the diagnosis of diseases of the genito-urinary tract is so great that a short account of the methods of preparing and examining specimens of pus and urine may be of use for practitioners.

For the methods of laboratory technique the author desires to acknowledge his indebtedness to Dr. T. W. Hastings, of the Cornell Laboratory of Clinical Pathology.

Urethral discharges, containing gonococci or other micro-organisms, may be examined by making a thin smear with a platinum needle, on a cover-glass, and submitting the smear to the following steps:—

I. Dry in the air.

II. Fix by passing the glass three times through a Bunsen flame.

III. Stain with Loeffler's solution for 2 to 3 minutes.

Formula:—Saturated alcoholic solution of methylene blue . . .30 c. cm.
Sol. potassium hydrate (1-1000) . . . . .100 c.cm.

IV. Wash in water.

V. Blot and dry.

VI. Mount in Canada balsam and examine with cedar-oil and oil-immersion objective.

Loeffler's solution stains all the organisms blue, and in order to differentiate the gonococci from other organisms, Gram's method must be used.

It is desirable to use this method of counter-staining not only to identify the gonococcus, but also to find other organisms which may be present in cases of mixed infection or of non-specific urethritis.

Gram's Method of Counter-staining:—

I. Dry and fix.

II. Stain with aniline gentian-violet, 1 to 3 minutes. (Do not wash or dry.) Made as follows:—

a. 2 per cent. sol. aniline oil in water; filter.
b. Sat. sol. gentian-violet, grams 2 to 100 c.cm of 95 per cent. alcohol.

Five parts of *a* to one part of *b*. Must be made fresh every week, as it spoils by keeping.

III. Gram's solution, 1 minute:—

Iodine crystals	1 gram.
Potassium iodide	2 grams.
Water	300 c.cm.

IV. Wash clear in alcohol, 95 per cent., about 1 minute.

V. Wash in basic fuchsine, 3 seconds to 1 minute.

Basic fuchsine	grms. 2.
Alcohol, 95 per cent.	100 c.cm.

Dilute before using with 5 to 10 volumes of alcohol.

VI. Wash in water.

VII. Blot and dry.

VIII. Examine, if on a slide, with cedar-oil placed on the slide. If on a cover-glass, mount in Canada balsam before so doing.

The Gram *positive* organisms retain the gentian stain and remain blue or bluish black.

The Gram *negative* organisms take counter-stain and are red.

List of Gram positive organisms remaining blue, most commonly found in genito-urinary conditions:—

Tubercle bacillus.
Staphylococcus.
Streptococcus.
Smegma bacillus.

Gram negative organisms remaining red:—

Gonococcus.
Micrococcus catarrhalis.
Bacilli: Colon group, mucous capsulatus, typhoid.

Prostatic secretion may be collected (*a*) in a test tube as it oozes from the meatus after massaging the prostate.

(*b*) It may be caught on a glass slide.

(*c*) The sediment from the expression urine may be used for examination after it has been thoroughly centrifugated.

The following **scheme of examination** is useful in examining secretions in a test-tube or the sediment of the centrifugated urine, and may also be used in cases of cystitis or pyelitis when tuberculosis is suspected.

I. Examine fresh, to get a general idea of the number of cells.

II. Stain fresh secretion by adding a drop of Loeffler's solution to it, and examine at once, to gain an idea of the type of cells.

III. Dry, fix, and stain with Loeffler's solution, to find bacteria.

IV. Dry, fix, and use Gram stain, to differentiate the types of bacteria.

V. Celloidin method may be used to identify shreds of tissue.

In order to dry, fix, and stain, the prostatic secretion or centrifugated sediment of the urine, may be treated as follows:—

I. Put on slide.

II. Spread with a needle, drying carefully over flame. Do not burn.

III. Fix by passing three times through the flame. Thorough fixing is necessary, otherwise the secretion washes off after staining.

IV. Stain with dilute methyl blue (Loeffler's solution), 1 to 2 minutes.

V. Wash.

VI. Blot with filter-paper.

VII. Fix again in flame.

VIII. Mount in Canada balsam and cover-glass, or put a drop of cedar-oil on slide and examine without a cover-glass.

Tubercle Bacilli.—In cases of suspected tuberculosis, cystitis, or pyelitis, the bacilli may, in most cases, be found by using the following methods:

If a very small amount of sediment is present after centrifugation, the celloidin method may be used, but the following plan is applicable to most cases:—

Hansell's Method:—

I. Centrifugate the urine 10 to 15 minutes, and use all the sediment to make a thick layer on the slide.

II. Dry by heat (slowly).

III. Fix in flame.

IV. Carbol-fuchsine stain, steam for 1 to 2 minutes.

℞ Sat. alcoholic sol. basic fuschine	10 c.cm
5 per cent. carbolic acid	100 c.cm.

V. Wash.

VI. Decolorize. Hansell's solution.

Acid alcohol, 95 per cent	97 parts.
Hydrochloric acid, c. p	3 parts.

Sputum decolorizes in 5 to 10 minutes.
Urine requires half an hour.

VII. Wash.

VIII. Blot.

IX. Counter-stain for 1 to 2 minutes with:—

1 per cent. methyl blue, aqueous sol.	
Alcohol, 95 per cent	equal parts.

X. Wash, blot, dry, and examine.

Tubercle bacilli are slim, curved at one end, beaded, and in clumps of two or three, and take a **red stain.**

If there is any doubt as to the identity of the tubercle bacillus, use steps 1, 2, 3, 4.

V. Decolorize, 25-per-cent. nitric or sulphuric acid, 3 to 5 minutes: if red color continue, use acid until washes clear with water.

VI. Wash, and if marked color returns, wash in acid again.

VII. Place in alcohol 95 per cent, 18 to 24 hours.

VIII. Wash, blot, and counter-stain.

Kanthac's method is particularly useful in finding the tubercle bacilli when the urine contains large quantities of pus. After centrifugating the urine or allowing it to

I. Stand in a conical glass, add to the sediment 5 or 10 times its bulk of 5-per-cent. carbolic acid, depending upon amount of pus.

II. Shake hard until particles are broken up.

III. Recentrifugate, or let it stand in a conical glass for 12 hours.

IV. Examine the last few drops at the bottom of the cone.

V. Stain the drops by Hansell's method.

The method of Inoscopy may be used if much blood is present; the clot is digested with artificial gastric juice, freeing the bacilli and allowing them to sink to the bottom.

I. Centrifugate the fibrin.

II. Add to the shreds 10 to 30 c.cm. of Jousset's fluid.

℞ Pepsine	grms. 2
Sodii fluoride	grms. 3
Acid hydrochloric	10 c.cm.
Glycerinæ	10 c.cm.
Water	1000 c.cm.

This solution keeps indefinitely.

III. Stand in warm box or over steam radiator over night, to digest fibrin.

IV. Centrifugate and examine last drop for tubercle bacilli.

V. Stain by Hansell's method or any other.

The Celloidin method is useful in examining urine containing shreds of tissue from a suspected tumor of the bladder, to determine if it is malignant or benign. It is also useful in examining the urine when tuberculosis of the bladder or kidney is thought to be present, and when but very little sediment can be obtained.

I. Slides fixed half hour at 36° C.

II. Flood with thin celloidin (collodion thinned down to consistency of water, with alcohol and ether, equal parts.)

III. Wash for a few seconds with cold tap water.

IV. Blot and dry.

V. Alcohol, 95 per cent., 5 to 10 minutes.

VI. Wash and dry.

VII. Stain with Delafield's hæmatoxyllin, 5 to 10 minutes.

VIII. Wash, stain with 1 per cent. aqueous solution of eosin, 5 to 20 seconds.

IX. Wash again.

X. Decolorize and dehydrate with 95-per-cent. alcohol, $^{1}/_{2}$ to 2 minutes.

XI. Absolute alcohol, 1 minute.

XII. Xylol, 1 minute.

XIII. Blot and dry.

XIV. Mount in balsam.

Spermatozoa.—In cases of sterility it is necessary to examine the semen to determine the presence or absence of spermatozoa. After massaging the seminal vesicles, spermatozoa, when present, can usually be found in the expression urine, but for a complete examination the patient should be directed to have sexual intercourse, using a condom, and the ejaculated semen contained in the condom should be examined as soon as possible.

The spermatozoa can be easily found when present. Staining brings them out more prominently. The method is as follows:—

I. Make smear.

II. Fix for half to one hour in 27 to 30 per cent. alcohol.

III. Stain 3 to 10 minutes in $^1/_2$ per cent. solution of eosin in glycerine.

IV. Wash in water.

V. Examine.

The heads stain pink and the tails faint pink.

Spirochæta Pallida.—To examine for the organism of syphilis, smears should be made with a platinum loop on cover slips, from the serum.

Serum may be obtained from the *chancre* by squeezing it or by cutting through its border with a sharp Hagedorn needle or a small lancet.

From *secondary* eruptions, the serum is obtained by scarifying or scraping their surfaces.

The serum is obtained from *mucous patches* by rubbing off the surface with gauze or alcohol.

The smear should be allowed to dry in the air and stained by one of the following methods:—

I. Giemsa method.

II. Goldhorn's method.

III. Nocht's method.

IV. Schaudinn's method, with Loeffler flagella stain.

Giemsa Method, furnished by the courtesy of Dr. Roescher, of Lesser's Clinic, Berlin:—

I. Dry in air.

II. Fix ten minutes in absolute alcohol.

III. Stain with Giemsa one and one-half hours by laying the cover-glass in a watch-glass, with the stain underneath.

IV. Wash in water.

V. Dry, mount in balsam, and examine.

The stain consists of:—

Giemsa II, Eosin	3.0
Azur II	0.8

Mix and rub fine, and filter through gauze.

Dissolve in glycerine, *pure,* 250 grams, for one hour, at a temperature of 60° C.

After cooling add methyl alcohol (Kalbaum I), 250 grams. Of this solution add 14 drops to 10 c.cm. of water for use.

Goldhorn's Method:—

I. Use smear which is well dried, but not by heat.

II. Flood with stain for three to five seconds.

III. Pour excess of stain back into bottle: can be used again.

IV. Place slide in glass of tap water, three to five seconds.

V. Wash by shaking in water.

VI. Drain off excess of water.

VII. Dry in air; do not blot or heat.

After staining, the slide should appear blue; if not, has been in water too long.

The spirochæta pallida appears reddish purple, while the refringens is bluer in color.

Goldhorn's stain can be bought ready for use from E. Leitz & Company.

Nocht's Method:—

I. Fix smears in methyl alcohol ten minutes (or absolute alcohol 20 to 30 minutes).

II. Wash and blot.

III. Stain with mixture of the three following solutions:—

(*a*) 1-per-cent. aqueous solution of eosin (water-soluble yellow).
(*b*) 1 bottle Unna's or Goldhorn's polychrome blue.
(*c*) 1 bottle aqueous methylene blue, Ehrlich's rectified.

These are for sale, put up in methyl alcohol, by E. Leitz.
They should be mixed in the following proportions:—

10 c.cm. of distilled water.
2 to 3 drops of eosin solution.
5 drops of polychrome methyl blue.
2 drops of 1 per cent. aqueous methyl blue.

They should be mixed in a flat Petri dish till a fine black precipitation occurs. Make fresh before using.

IV. Place fixed slide (blood side down) in watch-glass, and leave all night to stain (12 to 18 hours).

V. Wash.

VI. Mount in balsam.

Examine with a 3 or 4 eye-piece.

The spirochæta appears red or plum-colored.

Schaudinn's Method with Lœffler Flagella Stain.—This method is particularly valuable in studying the structure, bringing out the flagellæ.

I. Fix dried smear by holding slide over a solution of osmic acid 2 per cent. aqueous solution. The solution should be kept in a wide-mouthed bottle, capacity of 150 c.cm., and the slide dipped in the bottle, but not immersed in the fluid: 1 to 3 seconds.

II. Flood fixed smear with following solution, two minutes:—

20 per cent. tannic acid solution	100 c.cm.
Cold saturated solution ferrous sulphate (1 gram in 50 c.cm. of water)	50 c.cm.
Sat. alcoholic solution basic fuchsine	10 c.cm.

Allow the solution to stand 24 to 48 hours; open to the air to ripen.
After standing, add 6 to 8 drops of 2.5 per cent. sol. sodium hydroxide.

III. Wash thoroughly in water.

IV. Wash off excess of water and stain with carbol gentian violet 2 to 3 minutes.

Sat. alcoholic solution gentian violet	10 cc.
5 per cent. carbolic acid	100 cc.

V. Wash in water.

VI. Dry in air.

VII. Mount in balsam.

Spirochæte pallida takes a deep red stain, and many show flagellum at one or both ends.

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